

# Dense Regular Packings of Polyhedra

September 4, 2012

This document consists of two parts: in Section 1 we present tables which summarize the packing properties of the various particles we have studied (also see Ref. [1]), and in Section 2 full details are given of the unit cell associated with the close packed crystal lattice for each particle.

## 1 Tables of Packing Properties

In Tables 1 - 13 we consider 11 properties of dense regular packings for solids, particle models, and miscellaneous shapes. These results were established by analysing the crystal structures obtained by our combination of the floppy-box Monte Carlo (FBMC) technique [2] and a triangular-tessellation-based overlap routine as described in the main paper. The relevant crystal structures are given in Section 2. Additionally, we have included data along with this document to help in both constructing and visualizing the crystal structures. Included in the repository is a Mathematica notebook which can be directly used to visualize the particle, the close packed unit cell, and a sample crystal structure.

Tables 1 - 13 summarize the following properties:

1. The *centrosymmetry* of the particle. For a centrosymmetric particle there is an inversion point to the symmetry group that is associated to its shape. This property is abbreviated ‘CS’ and we use the symbols ‘C’ and ‘NC’ to indicate centrosymmetric and noncentrosymmetric shapes.
2. The number of particles  $N$  in the unit cell for which densest-known regular packing is achieved.
3. The value of the packing fraction  $\phi_{\text{LB}}$  for the densest-known crystal structure. This value has been rounded down to 5 decimals.
4. The decomposition of the structure into *centrosymmetric compounds*. For a centrosymmetric particle it is hypothesized that the densest-packed regular structure is always a Bravais lattice [3]. For non-centrosymmetric particles the arrangement of the particles in the crystal may be such that there is a Bravais sublattice with the same group of particles associated to each of its lattice sites. If the shape of this group is centrosymmetric we say that the particles pack densest by forming a centrosymmetric compound. For example, the densest-known packing of tetrahedra admits a Bravais sublattice by grouping the particles into centrosymmetric quadrumers [4]. In our definition we allow the group/compound to consist of one particle to also account for the Bravais lattices formed by centrosymmetric particles. We use the abbreviation ‘CS<sub>c</sub>’ and specify whether or not a centrosymmetric compound may be formed by the symbols: ‘y’ for yes and ‘n’ for no. We use a dash ‘-’ when we did not consider this property for a particular particle.
5. The possibility of a *space-filling compound*. The regular structure we obtain using the FBMC method can have a packing fraction of 1 at most. When a structure achieves a packing fraction of 1, it is space filling. There are also structures with lower packing fractions, for which the voids between the particles can be filled using another regular polyhedron. Such packings therefore admit a space-filling compound. We abbreviate this property by ‘SF<sub>c</sub>’. If the compound consists of Platonic and/or Archimedean solids it is called a uniform partition of 3-space (three-dimensional space), or uniform partition for short. We use capitalized symbols ‘Y’, ‘N’, and ‘-’ to indicate the space-filling potential of a packing and to differentiate from the symbols used for CS<sub>c</sub>.

6. The inscribed-sphere upper bound to the packing fraction  $\phi_{\text{UB}}$ . We established the radius  $R_{\text{I}}$  of the *maximum* inscribed sphere using constrained optimization and applied the procedure of Ref. [3] to arrive at this value:

$$\phi_{\text{UB}} = \min \left( 1, \frac{2\sqrt{2}\pi^2 R_{\text{I}}^3}{3V_{\text{M}}} \right), \quad (1)$$

with  $V_{\text{M}}$  the volume of the particle. This value has been rounded up to 5 decimals.

7. The outscribed-sphere lower bound  $\phi_{\text{OS}}$  to the maximum packing fraction. We determined the radius  $R_{\text{O}}$  of the *minimum* outscribed sphere using constrained optimization and obtain

$$\phi_{\text{OS}} = \frac{V_{\text{M}}}{4\sqrt{2}R_{\text{I}}^3}. \quad (2)$$

This value has been rounded down to 5 decimals.

8. The oriented-bounding-box lower bound  $\phi_{\text{OBB}}$  to the maximum packing fraction. We determine the volume  $V_{\text{OBB}}$  of *smallest* oriented bounding box using the method of Ref. [5] and obtain

$$\phi_{\text{OBB}} = \frac{V_{\text{M}}}{V_{\text{OBB}}}. \quad (3)$$

This value has been rounded down to 5 decimals.

9. The *sphericity*  $\gamma \equiv R_{\text{I}}/R_{\text{O}} \in [0, 1]$ , defined in analogy to the asphericity parameter of Ref. [3], which is the reciprocal of  $\gamma$ .

We supplemented the simulation based material with literature results and we put references in the footnotes wherever appropriate - only for 29 out of 159 entries a literature result is known. We also indicated with footnotes whenever the particles had colloid or microscopic shape equivalents.

Table 1: **Data for the Platonic solids.**

Code	CS	$N$ $\phi_{\text{UB}}$	$\phi_{\text{LB}}$ $\phi_{\text{OS}}$	$\text{CS}_c$ $\phi_{\text{OBB}}$	$\text{SF}_c$ $\gamma$	Name
PS01	NC	4 1.00000	0.85634 <sup>a</sup> 0.09072	y 0.33333	N 0.33333	Tetrahedron <sup>d</sup>
PS02	C	1 0.89343	0.83635 <sup>b</sup> 0.44833	y 0.51502	N 0.79465	Icosahedron <sup>d</sup>
PS03	C	1 0.98116	0.90450 <sup>b</sup> 0.49235	y 0.47745	N 0.79465	Dodecahedron <sup>d</sup>
PS04	C	1 1.00000	0.94736 <sup>b</sup> 0.23570	y 0.56218	Y <sup>c</sup> 0.57734	Octahedron <sup>d</sup>
PS05	C	1 1.00000	1.00000 <sup>b</sup> 0.27216	y 1.00000	Y <sup>c</sup> 0.57734	Cube <sup>d</sup>

<sup>a</sup> Ref. [4].

<sup>b</sup> Refs. [6, 3].

<sup>c</sup> Cubes are space filling [7, 8]. Octahedra and tetrahedra with equal edge lengths in a 1:2 ratio can form a uniform partition of 3-space [7].

<sup>d</sup> The following solids have a nanoparticle, colloid, or microscopic particle shape equivalent: tetrahedra [9, 10, 11], cubes [12, 13, 14, 15, 16], octahedra [17, 16, 15], dodecahedra [18] (microscopic), and icosahedra [19, 11, 20].

Table 2: **Data for the Archimedean solids.**

Code	CS	$N$	$\phi_{\text{LB}}$	$\text{CS}_c$	$\text{SF}_c$	Name
		$\phi_{\text{UB}}$	$\phi_{\text{OS}}$	$\phi_{\text{OBB}}$	$\gamma$	
AS01	NC	2	0.99519 <sup>a</sup>	y	Y <sup>d</sup>	
		1.00000	0.29718	0.41071	0.52223	Truncated Tetrahedron <sup>eh</sup>
AS02	C	1	0.78498 <sup>b</sup>	y	N	
		0.83856	0.64230	0.51351	0.91495	Truncated Icosahedron
AS03	NC	1	0.78769 <sup>b</sup>	n <sup>c</sup>	N	
		0.93492	0.57484	0.66109	0.85033	Snub Cube <sup>f</sup>
AS04	NC	1	0.78864 <sup>b</sup>	n <sup>c</sup>	N	
		0.85547	0.66367	0.53018	0.91886	Snub Dodecahedron
AS05	C	1	0.80470 <sup>b</sup>	y	N	
		0.83596	0.66075	0.54747	0.92459	Rhombicosidodecahedron
AS06	C	1	0.82721 <sup>b</sup>	y	N	
		0.89731	0.66498	0.53395	0.90494	Truncated Icosidodecahedron
AS07	C	1	0.84937 <sup>b</sup>	y	N	
		1.00000	0.59356	0.74491	0.82594	Truncated Cuboctahedron
AS08	C	1	0.86472 <sup>b</sup>	y	N	
		0.93800	0.57737	0.50464	0.85064	Icosidodecahedron
AS09	C	1	0.87580 <sup>b</sup>	y	N	
		0.87580	0.56262	0.61928	0.86285	Rhombicuboctahedron <sup>g</sup>
AS10	C	1	0.89778 <sup>b</sup>	y	N	
		0.97387	0.57413	0.50032	0.83850	Truncated Dodecahedron
AS11	C	1	0.91836 <sup>b</sup>	y	N	
		1.00000	0.41666	0.83333	0.70710	Cuboctahedron <sup>h</sup>
AS12	C	1	0.97374 <sup>b</sup>	y	Y <sup>d</sup>	
		1.00000	0.42712	0.96649	0.67859	Truncated Cube <sup>h</sup>
AS13	C	1	1.00000 <sup>b</sup>	y	Y <sup>d</sup>	
		1.00000	0.50596	0.53333	0.77459	Truncated Octahedron <sup>h</sup>

<sup>a</sup> Ref. [6].

<sup>b</sup> Refs. [21, 22].

<sup>c</sup> The snub cube and snub dodecahedron are *not* centrally symmetric, yet they achieve their densest packing in unit cell containing  $N = 1$  particles, *nor* do they form a centrosymmetric compound.

<sup>d</sup> Truncated tetrahedra and tetrahedra form a 2:6 space-filling compound with a 3:1 edge length ratio [21]. Cuboctahedra and octahedra form a 1:1 uniform partition of 3-space with 1:1 edge length ratio and truncated cubes and octahedra form a 1:1 uniform partition with edge length ratio 1:1 [7].

<sup>e</sup> For truncated tetrahedra we report a new dimer crystal structure with  $\phi_{\text{LB}} = 0.98854\dots$  [1]. The  $\phi_{\text{LB}}$  value in this table was obtained by analytic construction [21, 22].

<sup>f</sup> This result was established using 500 computer experiments for  $N = 1, \dots, 8$  with a slow pressure increase over  $4.5 \cdot 10^6$  MC cycles from  $p = 1$  to  $p = 1.2^{100}$  in 100 steps, followed by  $0.5 \cdot 10^6$  MC cycles of equilibration/production at that pressure. For each  $N$  and every run we obtained the Bravais lattice of Ref. [6] and the packing fraction deviated no more than 0.005 in absolute value from the literature value  $\phi_{\text{LB}} = 0.78769\dots$

<sup>g</sup> Rhombicuboctahedra achieve their densest packing in a crystal lattice [1].

<sup>h</sup> The following solids have a nanoparticle or colloid shape equivalent: truncated tetrahedra [23, 11], truncated cubes [23, 16, 15], truncated octahedra [24], and cuboctahedra [12, 16, 15].

Table 3: Data for the Catalan solids.

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
CS01	C	1 0.78287	0.77155 0.61878	y 0.53980	N 0.92459	Deltoidal Hexecontahedron
CS02	C	1 0.85134	0.79693 0.54691	y 0.54525	N 0.86285	Deltoidal Icositetrahedron <sup>c</sup>
CS03	C	1 0.81365	0.79328 0.45844	y 0.54603	N 0.82594	Disdyakis Dodecahedron
CS04	C	1 0.77313	0.76549 0.57295	y 0.54354	N 0.90494	Disdyakis Triacontahedron
CS05	NC	2 0.78283	0.74107 0.60732	n <sup>a</sup> 0.52603	N 0.91886	Pentagonal Hexecontahedron
CS06	NC	2 0.84856	0.74363 0.52174	n <sup>a</sup> 0.51407	N 0.85033	Pentagonal Icositetrahedron
CS07	C	1 0.78799	0.75755 0.60356	y 0.53419	N 0.91495	Pentakis Dodecahedron
CS08	C	1 1.00000	1.00000 0.35355	y 0.50000	Y <sup>b</sup> 0.70710	Rhombic Dodecahedron <sup>c</sup>
CS09	C	1 0.83462	0.80174 0.51374	y 0.59016	N 0.85064	Rhombic Triacontahedron
CS10	C	1 0.93728	0.87601 0.29289	y 0.63158	N 0.67859	Small Triakis Octahedron
CS11	C	1 0.87841	0.81401 0.40824	y 0.55555	N 0.77459	Tetrakis Hexahedron
CS12	C	1 0.81804	0.80479 0.48227	y 0.55402	N 0.83850	Triakis Icosahedron
CS13	NC	2 1.00000	0.79886 0.16329	y 0.59999	N 0.52223	Triakis Tetrahedron

<sup>a</sup> Note that the pentagonal hexecontahedron and pentagonal icositetrahedron are *not* centrally symmetric, yet these particles do *not* achieve their densest-known packing by forming a centrosymmetric compound.

<sup>b</sup> Rhombic dodecahedra are space filling [8].

<sup>c</sup> The following solids have a nanoparticle or colloid shape equivalent: rhombic dodecahedra [14, 13, 25, 26] and possibly deltoidal icositetrahedra [27, 28].

Table 4: **Data for the Johnson solids.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
JS01	NC	2 1.00000	0.88745 0.41071	- 0.49624	- 0.73848	Augmented Dodecahedron
JS02	NC	2 1.00000	0.97192 0.21678	- 0.69255	- 0.37819	Augmented Hexagonal Prism
JS03	NC	4 1.00000	0.90463 0.21120	- 0.66082	- 0.42422	Augmented Pentagonal Prism
JS04	NC	2 1.00000	0.83264 0.26330	- 0.44643	- 0.57631	Augmented Sphenocorona
JS05	NC	2 1.00000	0.94527 0.18200	- 0.57321	- 0.48671	Augmented Triangular Prism
JS06	NC	2 1.00000	0.85704 0.13072	- 0.28916	- 0.38646	Augmented Tridiminished Icosahedron
JS07	NC	2 1.00000	0.96347 0.40619	- 0.85433	- 0.63827	Augmented Truncated Cube
JS08	NC	1 <sup>a</sup> 1.00000	0.87969 0.54646	- 0.51399	- 0.81740	Augmented Truncated Dodecahedron
JS09	NC	2 1.00000	0.90795 0.27695	- 0.57813	- 0.57344	Augmented Truncated Tetrahedron
JS10	NC	2 1.00000	0.90677 0.16543	- 0.56196	- 0.37650	Biaugmented Pentagonal Prism
JS11	NC	2 1.00000	0.91501 0.22322	- 0.60549	- 0.48294	Biaugmented Triangular Prism
JS12	C	1 1.00000	0.96102 0.36374	y 0.78361	- 0.59153	Biaugmented Truncated Cube
JS13	NC	2 1.00000	0.81863 0.62385	- 0.58749	- 0.80687	Bigyrate Diminished Rhombicosidodecahedron
JS14	C	1 1.00000	0.95273 0.19876	- 0.62377	- 0.49112	Bilunabirotonda
JS15	NC	2 1.00000	0.82232 0.62385	- 0.57791	- 0.80687	Diminished Rhombicosidodecahedron
JS16	NC	2 1.00000	0.85634 0.07654	- 0.29003	- 0.33333	Dipyramid 3
JS17	NC	2 1.00000	0.84024 0.17317	- 0.32759	- 0.49112	Dipyramid 5
JS18	NC	2 1.00000	0.85870 0.37476	- 0.53256	- 0.69884	Disphenocingulum
JS19	NC	2 1.00000	0.83541 0.36461	- 0.65928	- 0.45045	Elongated Pentagonal Cupola
JS20	NC	2 1.00000	0.83751 0.38059	- 0.46158	- 0.67091	Elongated Pentagonal Dipyramid
JS21	C	1 1.00000	0.79475 0.44920	y 0.60407	- 0.60567	Elongated Pentagonal Gyrobicupola
JS22	C	1 1.00000	0.81918 0.43524	y 0.57603	- 0.74693	Elongated Pentagonal Gyrobirotunda
JS23	NC	2 1.00000	0.78374 0.51299	- 0.58594	- 0.79010	Elongated Pentagonal Gyrocupolartunda
JS24	NC	2 1.00000	0.79329 0.44920	- 0.60407	- 0.60567	Elongated Pentagonal Orthobicupola

Table 5: **Data for the Johnson solids - continued.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
JS25	NC	2 1.00000	0.81243 0.43524	- 0.57603	- 0.74693	Elongated Pentagonal Orthobirotunda
JS26	NC	2 1.00000	0.79266 0.51299	- 0.58594	- 0.79010	Elongated Pentagonal Orthocupolartunda
JS27	NC	2 1.00000	0.86656 0.35743	- 0.53225	- 0.67555	Elongated Pentagonal Pyramid
JS28	NC	2 1.00000	0.81652 0.44260	- 0.61737	- 0.65993	Elongated Pentagonal Rotunda
JS29	NC	2 1.00000	0.85746 0.43718	- 0.68054	- 0.61012	Elongated Square Cupola
JS30	C	1 1.00000	0.90995 0.14788	y 0.60947	- 0.41421	Elongated Square Dipyramid
JS31	NC	2 0.87580	0.80639 0.56262	- 0.61928	- 0.86285	Elongated Square Gyrobicupola
JS32	NC	2 1.00000	0.94371 0.21844	- 0.72385	- 0.49999	Elongated Square Pyramid
JS33	NC	2 1.00000	0.91258 0.35441	- 0.60017	- 0.65935	Elongated Triangular Cupola
JS34	NC	2 1.00000	0.83284 0.05180	- 0.29326	- 0.21927	Elongated Triangular Dipyramid
JS35	C	1 1.00000	0.87941 0.29486	y 0.62703	- 0.60243	Elongated Triangular Gyrobicupola
JS36	NC	2 1.00000	0.88043 0.29486	- 0.54326	- 0.60243	Elongated Triangular Orthobicupola
JS37	NC	4 1.00000	0.86089 0.09737	- 0.35016	- 0.28867	Elongated Triangular Pyramid
JS38	NC	2 1.00000	0.83325 0.58695	- 0.56431	- 0.77906	Gyrate Bidiminished Rhombicosidodecahedron
JS39	NC	1 <sup>a</sup> 0.83596	0.80470 0.66075	- 0.54302	- 0.92459	Gyrate Rhombicosidodecahedron
JS40	NC	2 1.00000	1.00000 0.15309	- 0.50000	$Y^b$ 0.43301	Gyrobifastigium
JS41	NC	2 1.00000	0.76412 0.42911	- 0.58293	- 0.57146	Gyroelongated Pentagonal Bicupola
JS42	NC	2 0.94171	0.77761 0.45641	- 0.55737	- 0.78549	Gyroelongated Pentagonal Birotunda
JS43	NC	4 1.00000	0.80695 0.34161	- 0.63982	- 0.41448	Gyroelongated Pentagonal Cupola
JS44	NC	2 1.00000	0.78540 0.51719	- 0.56621	- 0.78342	Gyroelongated Pentagonal Cupolartunda
JS45	NC	2 1.00000	0.86077 0.38637	- 0.50959	- 0.64079	Gyroelongated Pentagonal Pyramid

<sup>a</sup> Note that the gyrate rhombicosidodecahedron is *not* centrally symmetric, yet it achieves its densest-known packing for  $N = 1$  particles in the unit cell. However, the densest-known centrosymmetric-dimer lattice achieves a packing fraction remarkably close to that of the  $N = 1$  packing.

<sup>b</sup> The gyrobifastigium is space filling [8].

Table 6: **Data for the Johnson solids - continued.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
JS46	NC	2 1.00000	0.81250 0.44203	- 0.59756	- 0.63546	Gyroelongated Pentagonal Rotunda
JS47	NC	2 0.97994	0.77850 0.55378	- 0.54574	- 0.82676	Gyroelongated Square Bicapola
JS48	NC	2 1.00000	0.80712 0.42183	- 0.60324	- 0.56972	Gyroelongated Square Cupola
JS49	NC	2 1.00000	0.80261 0.17614	- 0.43129	- 0.51974	Gyroelongated Square Dipyramid
JS50	NC	2 1.00000	0.82236 0.25752	- 0.45133	- 0.59228	Gyroelongated Square Pyramid
JS51	NC	4 1.00000	0.79162 0.32153	- 0.52112	- 0.67198	Gyroelongated Triangular Bicapola
JS52	NC	2 1.00000	0.83145 0.37306	- 0.56343	- 0.64231	Gyroelongated Triangular Cupola
JS53	NC	2 1.00000	0.83853 0.36444	- 0.54634	- 0.62123	Hebesphenomegacorona
JS54	NC	2 1.00000	0.87796 0.38632	- 0.51502	- 0.71464	Metabiaugmented Dodecahedron
JS55	NC	2 1.00000	0.93602 0.18772	- 0.65039	- 0.35100	Metabiaugmented Hexagonal Prism
JS56	NC	2 1.00000	0.86978 0.53239	- 0.52766	- 0.80327	Metabiaugmented Truncated Dodecahedron
JS57	NC	2 1.00000	0.91942 0.32441	- 0.46065	- 0.57232	Metabidiminished Icosahedron
JS58	NC	2 1.00000	0.83373 0.58695	- 0.56431	- 0.77852	Metabidiminished Rhombicosidodecahedron
JS59	NC	1 <sup>a</sup> 0.83596	0.80470 0.66075	- 0.54302	- 0.92459	Metabigyrate Rhombicosidodecahedron
JS60	NC	1 <sup>a</sup> 1.00000	0.82056 0.62385	- 0.58749	- 0.80687	Metagyrate Diminished Rhombicosidodecahedron
JS61	C	1 1.00000	0.88941 0.33173	y 0.51502	- 0.67926	Parabiaugmented Dodecahedron
JS62	C	1 1.00000	0.97102 0.13937	y 0.65778	- 0.31783	Parabiaugmented Hexagonal Prism
JS63	C	1 1.00000	0.88053 0.51540	y 0.52766	- 0.79465	Parabiaugmented Truncated Dodecahedron
JS64	C	1 1.00000	0.85486 0.58695	y 0.63661	- 0.68915	Parabidiminished Rhombicosidodecahedron
JS65	C	1 0.83596	0.80470 0.66075	y 0.55217	- 0.92459	Parabigyrate Rhombicosidodecahedron

<sup>a</sup> Note that the metabigyrate rhombicosidodecahedron and metagyrate diminished rhombicosidodecahedron are *not* centrally symmetric, yet they achieve their densest-known packing in unit cell containing  $N = 1$  particles.

Table 7: **Data for the Johnson solids - continued.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
JS66	NC	1 <sup>a</sup> 1.00000	0.82048 0.62385	- 0.57791	- 0.80687	Paragryrate Diminished Rhombicosido-decahedron
JS67	NC	2 1.00000	0.85648 0.09698	- 0.44385	- 0.16245	Pentagonal Cupola
JS68	C	1 1.00000	0.85891 0.19397	y 0.44385	- 0.32491	Pentagonal Gyrobicupola
JS69	NC	2 1.00000	0.84969 0.38567	- 0.48784	- 0.58777	Pentagonal Gyrocupolarotunda
JS70	NC	2 1.00000	0.82381 0.19397	- 0.44385	- 0.32491	Pentagonal Orthobicupola
JS71	NC	2 0.93800	0.81713 0.57737	- 0.50464	- 0.85064	Pentagonal Orthobirotunda
JS72	NC	2 1.00000	0.83123 0.38567	- 0.48784	- 0.58777	Pentagonal Orthocupolarotunda
JS73	NC	2 1.00000	0.85874 0.28868	- 0.50464	- 0.42532	Pentagonal Rotunda
JS74	NC	2 1.00000	0.94582 0.11785	- 0.33333	- 0.36601	Pyramid 4
JS75	NC	2 1.00000	0.80887 0.08658	- 0.23032	- 0.27365	Pyramid 5
JS76	NC	2 1.00000	0.86477 0.18900	- 0.65970	- 0.48676	Snub Disphenoid
JS77	NC	4 1.00000	0.81981 0.34434	- 0.52936	- 0.55150	Snub Square Antiprism
JS78	NC	2 1.00000	0.82102 0.27733	- 0.44893	- 0.58532	Sphenocorona
JS79	NC	2 1.00000	0.85093 0.16304	- 0.39771	- 0.44699	Sphenomegacorona
JS80	NC	2 1.00000	0.94227 0.15397	- 0.47140	- 0.27059	Square Cupola
JS81	NC	2 1.00000	0.82692 0.30795	- 0.47140	- 0.54119	Square Gyrobicupola
JS82	C	1 1.00000	0.94249 0.30795	y 0.55228	- 0.54119	Square Orthobicupola
JS83	NC	2 1.00000	0.91836 0.20833	- 0.41666	- 0.40824	Triangular Cupola
JS84	NC	2 1.00000	0.87496 0.26151	- 0.47213	- 0.49999	Triangular Hebesphenorotunda
JS85	NC	2 1.00000	0.88316 0.41666	- 0.52465	- 0.70710	Triangular Orthobicupola
JS86	NC	2 1.00000	0.87421 0.36090	- 0.52502	- 0.69033	Triaugmented Dodecahedron
JS87	NC	2 1.00000	0.89315 0.15008	- 0.49731	- 0.31783	Triaugmented Hexagonal Prism

<sup>a</sup> Note the paragryrate diminished rhombicosidodecahedron is *not* centrally symmetric, yet it achieves its densest-known packing for  $N = 1$  particles in the unit cell. However, the densest-known centrosymmetric-dimer lattice achieves a packing fraction remarkably close to that of the  $N = 1$  packing.



Table 8: **Data for the Johnson solids - continued.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
JS88	NC	2 1.00000	0.82855 0.20411	- 0.42377	- 0.50211	Triaugmented Triangular Prism
JS89	NC	2 1.00000	0.86679 0.52875	- 0.53355	- 0.79465	Triaugmented Truncated Dodecahedron
JS90	NC	2 1.00000	0.91669 0.26245	- 0.37267	- 0.50209	Tridiminished Icosahedron
JS91	NC	2 1.00000	0.84993 0.55005	- 0.52883	- 0.73251	Tridiminished Rhombicosidodecahedron
JS92	NC	2 0.83596	0.80456 0.66075	- 0.54302	- 0.92459	Trigurate Rhombicosidodecahedron

Table 9: **Data for regular prisms.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
RP03	NC	2 1.00000	1.00000 <sup>a</sup> 0.17181	y 0.50000	Y <sup>c</sup> 0.37796	Prism 3
RP04	C	1 1.00000	1.00000 <sup>a</sup> 0.27216	y 1.00000	Y <sup>c</sup> 0.57734	Cube
RP05	NC	2 1.00000	0.92131 <sup>a</sup> 0.31659	y 0.69098	N 0.50673	Prism 5
RP06	C	1 1.00000	1.00000 <sup>a</sup> 0.32863	y 0.75000	Y <sup>c</sup> 0.44721	Prism 6
RP07	NC	2 1.00000	0.89269 <sup>a</sup> 0.32407	y 0.73825	N 0.39803	Prism 7
RP08	C	1 1.00000	0.90615 <sup>a</sup> 0.31175	y 0.82842	Y <sup>c</sup> 0.35740	Prism 8
RP09	NC	2 1.00000	0.90103 <sup>b</sup> 0.29629	y 0.75712	N 0.32361	Prism 9
RP10	C	1 1.00000	0.91371 <sup>a</sup> 0.28003	y 0.77254	N 0.29524	Prism 10

<sup>a</sup> We used Ref. [29] to compare our results to the literature studies of two-dimensional (2D) regular polygons. See Table 1 for more information on the cube.

<sup>b</sup> For regular enneaprisms (9-gonal base) we discovered a new packing, which also improves upon the result of Ref. [29] for the regular 9-gon (enneagon, nonagon) [1].

<sup>c</sup> Cubes (square base), as well as regular tri- (triangular base) and hexaprisms (hexagonal base) are space filling [7, 8].

Table 10: **Data for regular antiprisms.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
AP03	C	1 1.00000	0.94736 0.23570	y 0.56218	Y 0.57734	Octahedron <sup>a</sup>
AP04	NC	2 1.00000	0.86343 0.30385	y 0.66666	N 0.51108	Antiprism 4
AP05	C	1 1.00000	0.92052 0.32441	y 0.67418	N 0.44721	Antiprism 5
AP06	NC	2 1.00000	0.88189 0.32114	y 0.73204	N 0.39331	Antiprism 6
AP07	C	1 1.00000	0.90137 0.30741	y 0.72740	N 0.34904	Antiprism 7
AP08	NC	2 1.00000	0.89332 0.28987	y 0.75526	N 0.31270	Antiprism 8
AP09	C	1 1.00000	0.90672 0.27164	y 0.75000	N 0.28264	Antiprism 9
AP10	NC	2 1.00000	0.89731 0.25411	y 0.76608	N 0.25750	Antiprism 10

<sup>a</sup> See Table 1 for more information on the octahedron.

Table 11: **Data for several miscellaneous solids.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
MS01	C	1 1.00000	0.98926 0.31151	y 0.60300	N 0.59880	Dürer's Solid <sup>b</sup>
MS02	C	1 1.00000	1.00000 0.31426	y 0.66666	Y <sup>a</sup> 0.57734	Elongated Dodecahedron
MS03	C	1 0.79473	0.79473 0.60457	y 0.54914	N 0.91286	Rhombic Enneacontrahedron <sup>c</sup>
MS04	C	1 1.00000	0.82280 0.34650	y 0.52786	N 0.64945	Rhombic Icosahedron
MS05	NC	2 1.00000	1.00000 0.35355	y 0.50000	Y <sup>a</sup> 0.70710	Squashed Dodecahedron
MS06	NC	4 1.00000	0.70503 0.13380	n 0.31616	N 0.41221	Stanford Bunny <sup>d</sup>
MS07	NC	2 1.00000	0.47242 0.00853	y 0.06853	N 0.11355	Hammerhead Shark <sup>d</sup>

<sup>a</sup> The elongated dodecahedron and the squashed dodecahedron are space filling.

<sup>b</sup> Note that Dürer's solid is not the same as the dimer compound formed by truncated tetrahedra.

<sup>c</sup> For the rhombic enneacontrahedron we proved that the Bravais lattice we discovered achieves the densest packing [1].

<sup>d</sup> For the Stanford bunny [30] and the hammerhead shark [31] the number of triangles that comprise these models is very high, 3,756 and 5,116 triangles, respectively, however all quantities could be established with the appropriate accuracy.

Table 12: **Data for nonconvex polyhedra.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
PH01	NC	2 1.00000	0.61327 0.04157	n 0.23149	N 0.17469	Császár Polyhedron
PH02	C	1 1.00000	0.29477 0.07659	y 0.06269	N 0.26640	Echidnahedron
PH03	C	1 1.00000	1.00000 0.22922	y 0.45845	$Y^a$ 0.55284	Escher's Solid
PH04	C	1 1.00000	0.55728 0.21644	y 0.20989	N 0.51160	Great Rhombictriacontrahedron
PH05	C	2 1.00000	0.88967 0.18806	n 0.18237	N 0.18759	Great Stellated Dodecahedron
PH06	C	1 1.00000	0.74965 0.34558	y 0.39699	N 0.53633	Jessen's Orthogonal Icosahedron
PH07	C	1 1.00000	0.55602 0.20643	y 0.20019	N 0.51455	Mathematica Spikey 1 <sup>b</sup>
PH08	C	1 1.00000	0.59998 0.14378	y 0.20246	N 0.35355	Rhombic Dodecahedron Stellation 2 <sup>c</sup>
PH09	C	2 1.00000	0.55654 0.19854	n 0.19253	N 0.41946	Rhombic Hexecontrahedron
PH10	C	2 0.97719	0.69528 0.49635	n 0.47293	N 0.79787	Small Triambic Icosahedron
PH11	NC	2 1.00000	0.51913 0.03637	y 0.13732	N 0.16538	Szilassi Polyhedron

<sup>a</sup> Escher's solid is space filling by construction.

<sup>b</sup> The number '1' in the name 'Mathematica spikey 1' refers to the first version of the Mathematica spikey, which was used as a logo for the first version of the Mathematica software package [32]. It is a cumulated icosahedron with cumulation ratio  $\sqrt{6}/3$ .

<sup>c</sup> The number '2' in the name 'rhombic dodecahedron stellation 2' refers to the fact that there are three stellations of the rhombic dodecahedron (four when including the original). This particular stellation is listed as number '2' in the Mathematica polyhedron database [33].

Table 13: **Data for nonconvex nanoparticle and colloid models.**

Code	CS	$N$ $\phi_{UB}$	$\phi_{LB}$ $\phi_{OS}$	$CS_c$ $\phi_{OBB}$	$SF_c$ $\gamma$	Name
PA01	NC	4 1.00000	0.51850 0.18253	n 0.27282	N 0.155754	Cap <sup>b,c</sup>
PA02	C	1 1.00000	0.68615 0.09602	y 0.22903	N 0.38489	Nanostar <sup>c</sup>
PA03	C	1 1.00000	0.31077 0.02525	y 0.06681	N 0.13281	Octapod <sup>c</sup>
PA04	NC	2 <sup>a</sup> 1.00000	0.59207 0.04864	y 0.10628	N 0.20303	Tetrapod <sup>c</sup>

<sup>a</sup> The tetrapod model achieves its densest-known packing for  $N = 2$  particles in the unit cell, however, the  $N = 1$  the packing fraction is remarkably close to that value.

<sup>b</sup> Our cap model [34] is comprised of 3,850 triangles. Despite this model's complexity, all quantities could be established with the appropriate accuracy.

<sup>c</sup> The solids were modelled after the following nanoparticles and colloids: caps [35, 36, 34], nanostars [37, 38, 17, 39], octapods [40, 41, 42, 43, 44], and tetrapods [45, 46].

## 2 Unit cells for densest packed structures

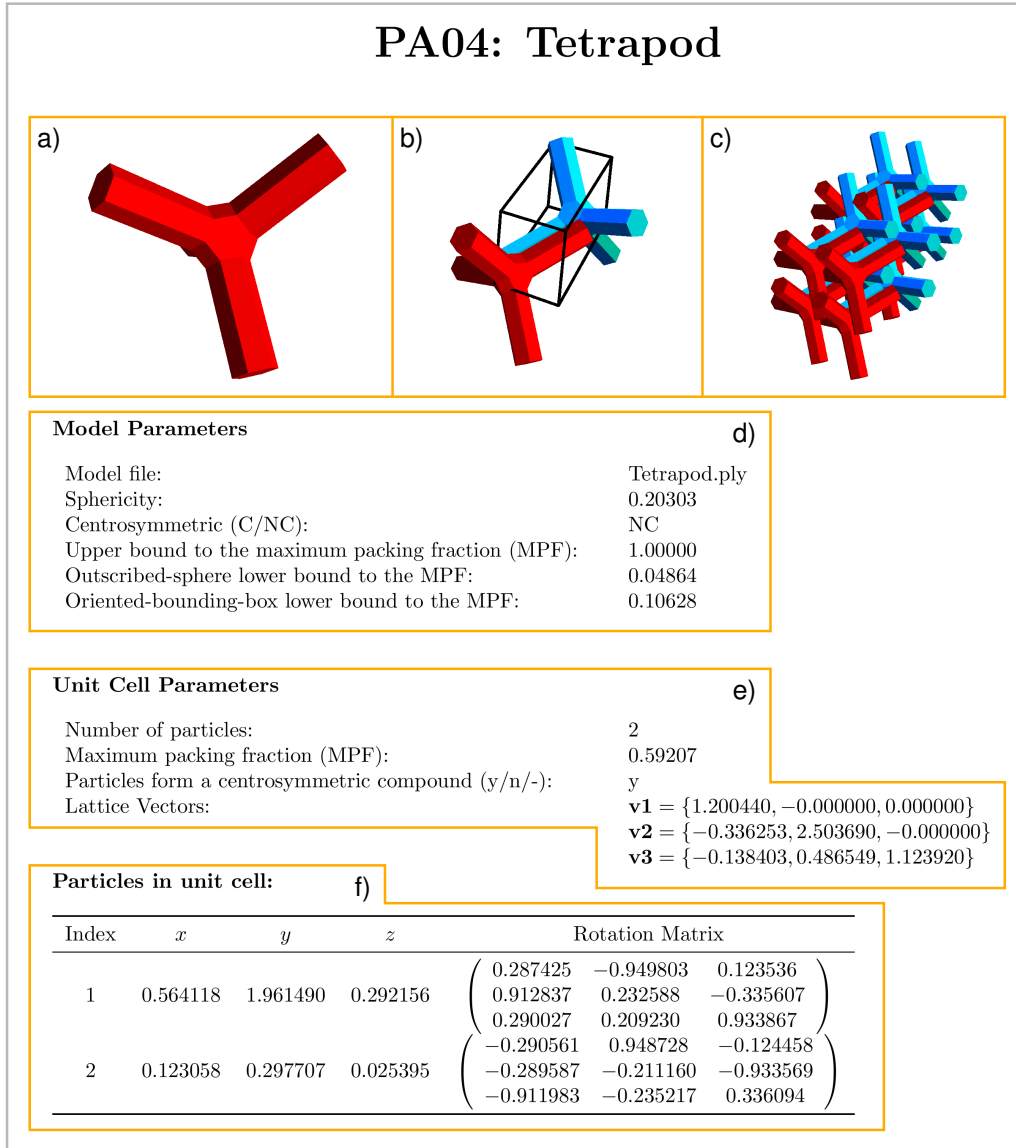


Figure 1: Close packed unit cell for a tetrapod.

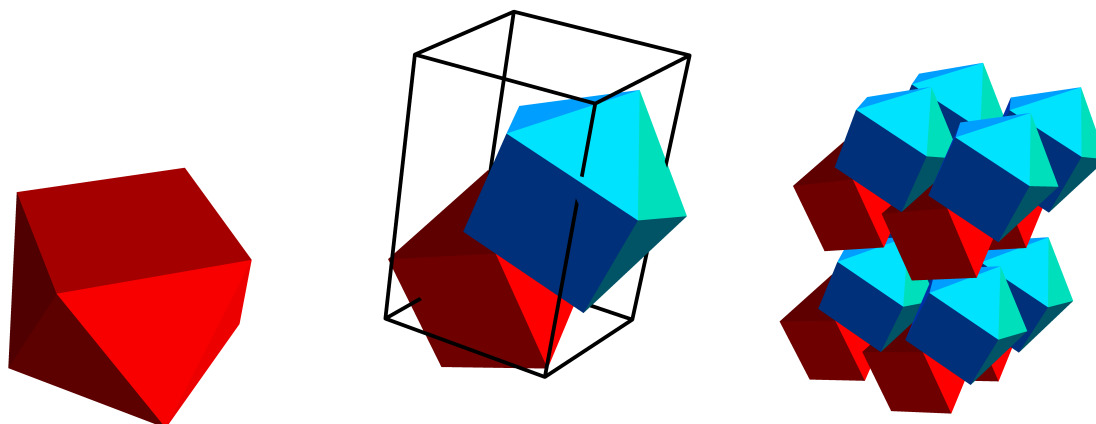
In this section we present the crystal structures associated with the closest packed arrangement we found for each particle shape; in alphabetical order of the particle name. An example of the data presented here is shown in Figure 1. For each shape we give

1. figures depicting the particle (Fig. 1a), the unit cell (Fig 1b), and a small piece of the crystal that the unit cell generates (Fig 1c)
2. the *model file* (model.ply) which can be used to construct the model particle and gives the orientation we used for the particle. The file can be found in the repository associated with this paper (Fig 1d).
3. the sphericity  $\gamma$  of the model that we used (Fig 1d).
4. the upper bound to the maximum packing fraction  $\phi_{UB}$  that we obtained (Fig 1d).

5. the outscribed-sphere lower bound to the maximum packing fraction  $\phi_{OS}$  (Fig 1d).
6. the oriented-bounding-box lower bound to the maximum packing fraction  $\phi_{OBB}$  (Fig 1d).
7. the number of particles in the unit cell  $N$  (Fig 1e).
8. the maximum packing fraction  $\phi_{LB}$  for this particle shape (Fig 1e).
9. the possible centrosymmetric way ( $CS_c$ ) in which the particles arrange in the unit cell (Fig 1e).
10. the lattice vectors for the unit cell (Fig 1e), one is located in the origin.
11. the position vectors for particles in the unit cell (Fig 1f). This vector specifies the translation of the particle's centre (origin model.ply file) with respect to the origin.
12. the orientation of the particles is specified by the rotation matrix (Fig 1f). This matrix takes the particle's initial orientation (rotated around the origin in the model.ply file) to the orientation in the unit cell.

All vector and matrix values are indicated to an accuracy of 6 decimals and are taken with respect to a standard Cartesian coordinate frame. Rounding of the values may lead to small overlaps in the system, when the numbers in the tables are used, we therefore refer the reader to the repository for reproduction purposes. Note that we have also provided in the repository a Mathematica notebook which can be used to visualize (in 3D) the particles and the unit cells. The figures shown in this section have all been produced with a version of this Mathematica notebook.

# AP04: Antiprism 4



## Model Parameters

Model file: Antiprism\_4.ply  
 Sphericity: 0.51108  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.30385  
 Oriented-bounding-box lower bound to the MPF: 0.66666

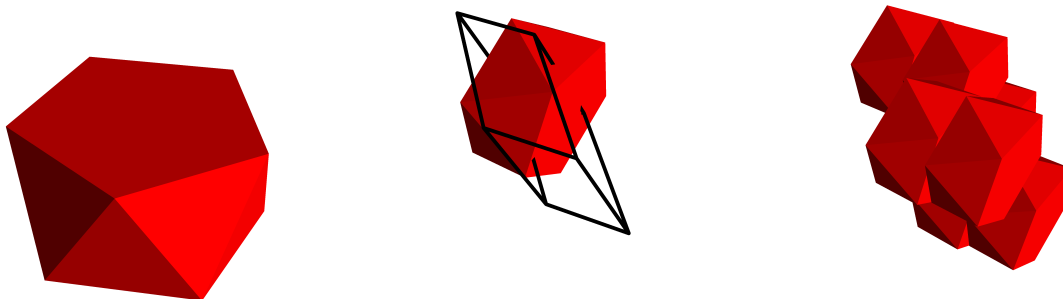
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.86343  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.325940, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.275009, 0.853953, 0.000000\}$   
 $\mathbf{v3} = \{0.132544, 0.386697, 2.045710\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.188460	0.689008	1.101270	$\begin{pmatrix} 0.371633 & -0.036110 & 0.927677 \\ 0.928380 & 0.014455 & -0.371351 \\ -0.000000 & 0.999243 & 0.038896 \\ -0.928380 & -0.014455 & 0.371351 \end{pmatrix}$
2	0.518936	0.729904	0.050656	

# AP05: Antiprism 5



## Model Parameters

Model file:	Antiprism_5.ply
Sphericity:	0.44721
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.32441
Oriented-bounding-box lower bound to the MPF:	0.67418

## Unit Cell Parameters

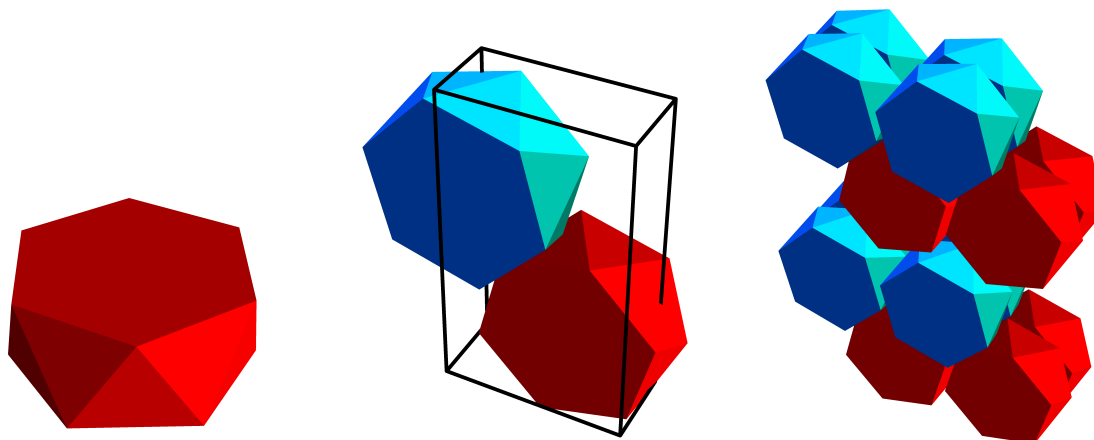
Number of particles:	1
Maximum packing fraction (MPF):	0.92052
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{0.743054, 0.000000, 0.000000\}$ $\mathbf{v2} = \{1.060530, -1.297000, 0.000000\}$ $\mathbf{v3} = \{0.143360, 0.648477, -1.129510\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.518496	0.427942	-0.958799	$\begin{pmatrix} 0.166920 & -0.057220 & 0.984309 \\ 0.074157 & 0.996216 & 0.045336 \\ -0.983178 & 0.065426 & 0.170531 \end{pmatrix}$



# AP06: Antiprism 6



## Model Parameters

Model file:	Antiprism_6.ply
Sphericity:	0.39331
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.32114
Oriented-bounding-box lower bound to the MPF:	0.73204

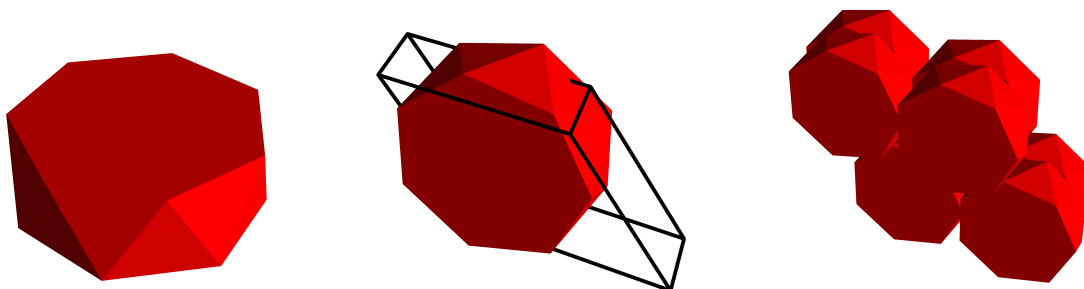
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.88189
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.455670, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.014722, 0.644703, -0.000000\}$ $\mathbf{v3} = \{0.014440, -0.035120, -2.416510\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.097218	0.337344	-0.833305	$\begin{pmatrix} 0.711719 & -0.004495 & -0.702450 \\ -0.702464 & -0.004553 & -0.711705 \\ 0.000001 & 0.999980 & -0.006398 \end{pmatrix}$
2	0.838749	0.613879	-2.043260	$\begin{pmatrix} 0.964211 & 0.001696 & 0.265129 \\ -0.265135 & 0.006169 & 0.964192 \\ -0.000000 & -0.999980 & 0.006398 \end{pmatrix}$

# AP07: Antiprism 7



## Model Parameters

Model file:	Antiprism_7.ply
Sphericity:	0.34904
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.30741
Oriented-bounding-box lower bound to the MPF:	0.72740

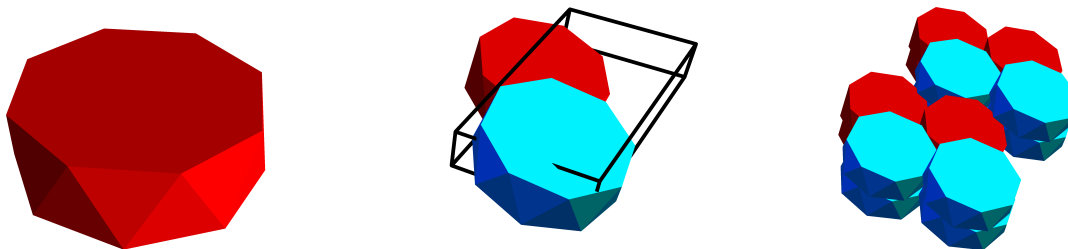
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.90137
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.508920, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.133063, 0.570100, 0.000000\}$ $\mathbf{v3} = \{-0.692107, -0.260783, 1.289660\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.123196	0.082065	0.717729	$\begin{pmatrix} -0.613766 & -0.058966 & 0.787283 \\ 0.783172 & 0.080412 & 0.616584 \\ -0.099664 & 0.995016 & -0.003173 \end{pmatrix}$

# AP08: Antiprism 8



## Model Parameters

Model file: Antiprism\_8.ply  
 Sphericity: 0.31270  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.28987  
 Oriented-bounding-box lower bound to the MPF: 0.75526

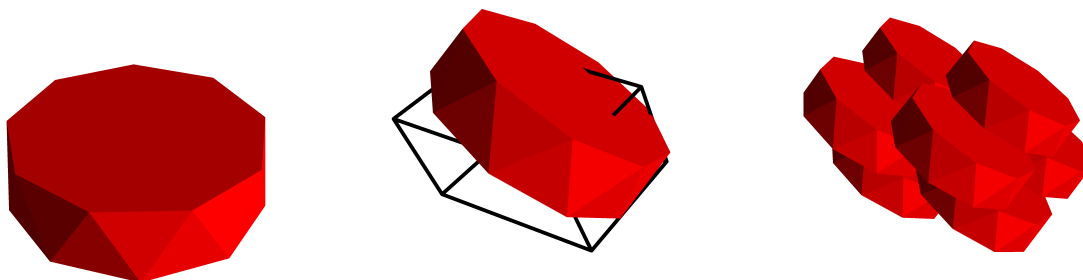
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.89332  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.607900, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.098190, -2.669980, 0.000000\}$   
 $\mathbf{v3} = \{-0.117459, 0.055436, -0.521521\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.989683	-2.290130	-0.196439	$\begin{pmatrix} 0.217284 & -0.974047 & -0.063409 \\ -0.918688 & -0.226022 & 0.323924 \\ -0.329849 & -0.012131 & -0.943956 \\ -0.150822 & -0.986397 & 0.065378 \\ -0.931908 & 0.163934 & 0.323533 \\ -0.329849 & -0.012131 & -0.943956 \end{pmatrix}$
2	0.077908	-0.927416	-0.457199	

# AP09: Antiprism 9



## Model Parameters

Model file:	Antiprism_9.ply
Sphericity:	0.28264
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.27164
Oriented-bounding-box lower bound to the MPF:	0.75000

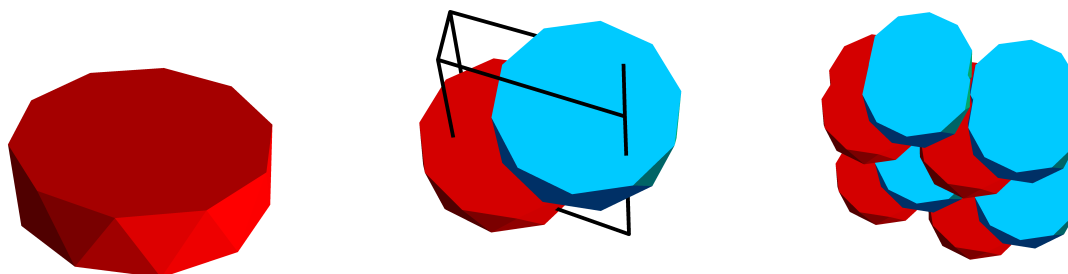
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.90672
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.223290, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.085506, -1.142430, 0.000000\}$ $\mathbf{v3} = \{0.161815, 0.241670, -0.789170\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.780488	-0.542676	-0.022968	$\begin{pmatrix} -0.450142 & -0.698570 & 0.556212 \\ -0.798131 & 0.594091 & 0.100217 \\ -0.400449 & -0.398818 & -0.824975 \end{pmatrix}$

# AP10: Antiprism 10



## Model Parameters

Model file: Antiprism\_10.ply  
 Sphericity: 0.25750  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.25411  
 Oriented-bounding-box lower bound to the MPF: 0.76608

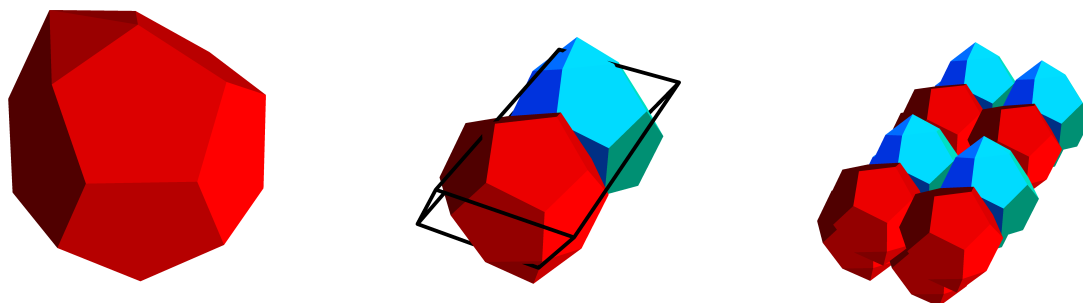
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.89731  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.873190, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-0.382124, 0.798256, 0.000000\}$   
 $\mathbf{v3} = \{-0.022159, -0.214750, 1.490610\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.311450	0.156989	1.095600	$\begin{pmatrix} 0.968923 & 0.075130 & -0.235679 \\ 0.042898 & 0.887290 & 0.459213 \\ 0.243616 & -0.455052 & 0.856492 \end{pmatrix}$
2	0.385936	0.264364	0.350295	$\begin{pmatrix} 0.809090 & 0.582317 & 0.079250 \\ 0.534813 & -0.673673 & -0.510039 \\ -0.243616 & 0.455052 & -0.856492 \end{pmatrix}$

# JS01: Augmented Dodecahedron



## Model Parameters

Model file: Augmented\_Dodecahedron.ply  
 Sphericity: 0.73848  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.41071  
 Oriented-bounding-box lower bound to the MPF: 0.49624

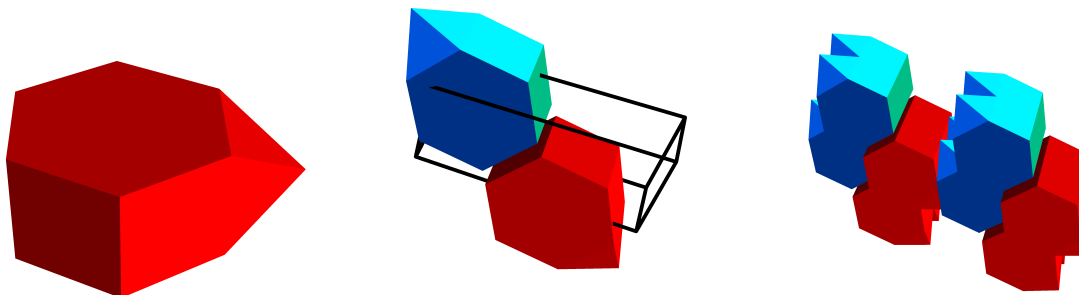
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.88745  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.157080, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-0.157371, 2.242870, -0.000000\}$   
 $\mathbf{v3} = \{-0.543580, 0.458675, -0.868390\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.199353	2.081980	-0.608479	$\begin{pmatrix} 0.923661 & -0.316615 & -0.215883 \\ 0.236894 & 0.914577 & -0.327765 \\ 0.301217 & 0.251603 & 0.919763 \end{pmatrix}$
2	0.219668	0.927393	-0.535710	$\begin{pmatrix} -0.599261 & -0.428871 & 0.675985 \\ -0.798771 & 0.376642 & -0.469154 \\ -0.053398 & -0.821103 & -0.568277 \end{pmatrix}$

# JS02: Augmented Hexagonal Prism



## Model Parameters

Model file:	Augmented_Hexagonal_Prism.ply
Sphericity:	0.37819
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.21678
Oriented-bounding-box lower bound to the MPF:	0.69255

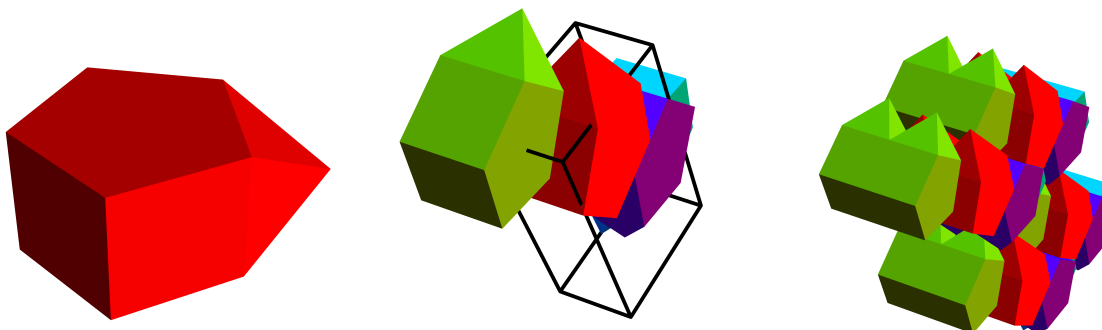
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.97192
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.567810, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.196412, 0.678817, 0.000000\}$ $\mathbf{v3} = \{-0.442127, 0.265233, -1.180540\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.262425	0.423711	-0.187827	$\begin{pmatrix} -0.118018 & -0.034148 & 0.992424 \\ -0.953320 & -0.275838 & -0.122859 \\ 0.277943 & -0.960597 & 0.000000 \end{pmatrix}$
2	1.233540	0.380210	-1.179890	$\begin{pmatrix} 0.118018 & 0.034148 & -0.992424 \\ 0.953320 & 0.275838 & 0.122859 \\ 0.277943 & -0.960597 & 0.000000 \end{pmatrix}$

# JS03: Augmented Pentagonal Prism



## Model Parameters

Model file: Augmented\_Pentagonal\_Prism.ply  
 Sphericity: 0.42422  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.21120  
 Oriented-bounding-box lower bound to the MPF: 0.66082

## Unit Cell Parameters

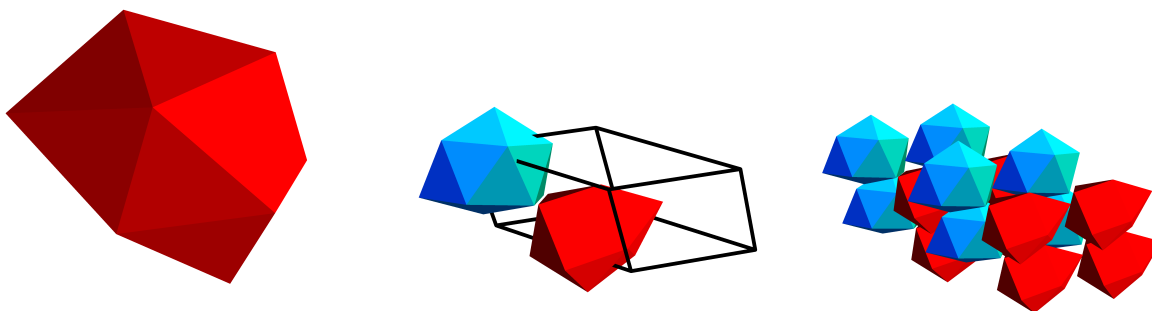
Number of particles: 4  
 Maximum packing fraction (MPF): 0.90463  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{0.799583, -0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-0.142957, 1.940890, -0.000000\}$   
 $\mathbf{v3} = \{-0.033003, 1.402160, -2.849190\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.063644	0.028097	0.083433	$\begin{pmatrix} -0.000000 & 0.955951 & 0.293527 \\ -0.000000 & -0.293527 & 0.955951 \\ 1.000000 & 0.000000 & 0.000000 \end{pmatrix}$
2	-0.000690	2.841890	-1.855580	$\begin{pmatrix} 0.000000 & -0.955951 & -0.293528 \\ 0.000000 & 0.293528 & -0.955951 \\ 1.000000 & 0.000000 & 0.000000 \end{pmatrix}$
3	0.430433	1.924390	-1.297210	$\begin{pmatrix} -0.000000 & 0.574566 & -0.818458 \\ 0.000000 & -0.818458 & -0.574566 \\ -1.000000 & -0.000000 & -0.000000 \end{pmatrix}$
4	0.432105	0.945603	-0.474941	$\begin{pmatrix} -0.000000 & 0.600849 & 0.799362 \\ 0.000000 & -0.799362 & 0.600849 \\ 1.000000 & 0.000000 & 0.000000 \end{pmatrix}$



# JS04: Augmented Sphenocorona



## Model Parameters

Model file: Augmented\_Sphenocorona.ply  
 Sphericity: 0.57631  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.26330  
 Oriented-bounding-box lower bound to the MPF: 0.44643

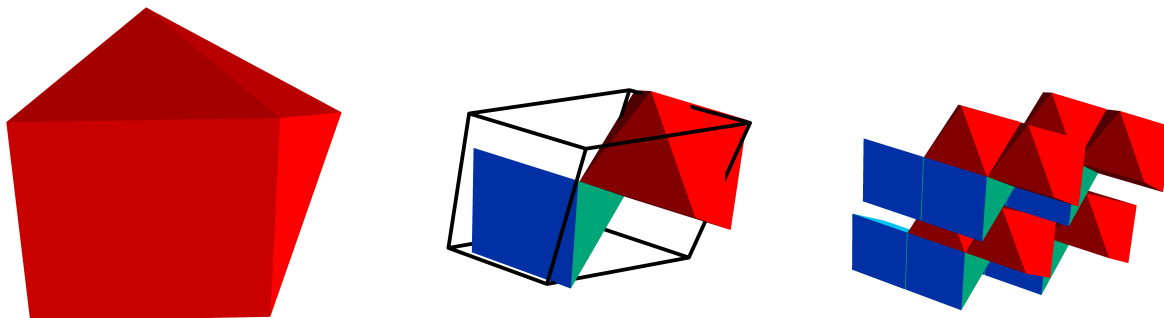
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.83264  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.882970, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-1.145420, -1.081690, -0.000000\}$   
 $\mathbf{v3} = \{-0.246130, -0.131475, 1.179310\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-1.158580	-1.040650	0.845349	$\begin{pmatrix} 0.999636 & -0.017450 & 0.020573 \\ -0.004622 & 0.640553 & 0.767900 \\ -0.026578 & -0.767715 & 0.640240 \end{pmatrix}$
2	0.066800	-0.896279	0.213798	$\begin{pmatrix} -0.147873 & -0.532412 & -0.833470 \\ -0.984390 & -0.002093 & 0.175986 \\ -0.095442 & 0.846483 & -0.523791 \end{pmatrix}$

# JS05: Augmented Triangular Prism



## Model Parameters

Model file:	Augmented_Triangular_Prism.ply
Sphericity:	0.48671
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.18200
Oriented-bounding-box lower bound to the MPF:	0.57321

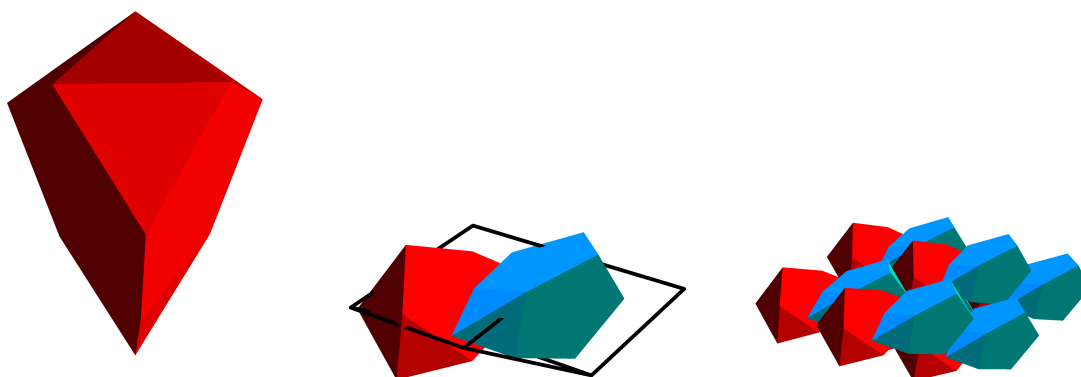
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.94527
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.143840, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-1.030890, -1.007180, 0.000000\}$ $\mathbf{v3} = \{0.548057, -0.203494, 1.843480\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.213593	-0.473590	0.338655	$\begin{pmatrix} 0.019240 & 0.985439 & -0.168938 \\ 0.012227 & -0.169188 & -0.985508 \\ -0.999740 & 0.016895 & -0.015304 \\ -0.018766 & -0.985447 & 0.168945 \\ -0.012915 & 0.169200 & 0.985497 \\ -0.999740 & 0.016312 & -0.015903 \end{pmatrix}$
2	0.921710	-0.181533	1.199000	

# JS06: Augmented Tridiminished Icosahedron



## Model Parameters

Model file:	Augmented_Tridiminished_Icosahedron.ply
Sphericity:	0.38646
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.13072
Oriented-bounding-box lower bound to the MPF:	0.28916

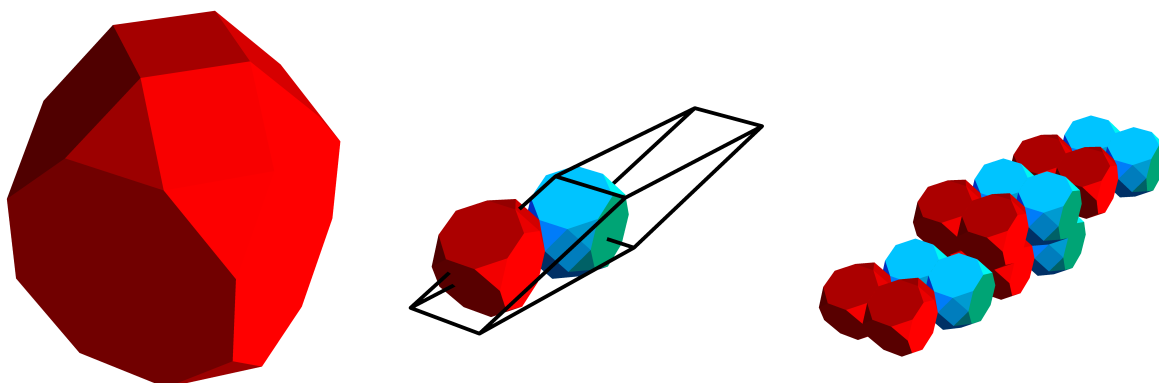
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.85704
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.396430, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.315153, 1.990910, -0.000000\}$ $\mathbf{v3} = \{0.923957, 1.117540, -0.841475\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.605770	1.475550	-0.214820	$\begin{pmatrix} 0.935687 & -0.341576 & -0.088411 \\ -0.120189 & -0.072976 & -0.990065 \\ 0.331731 & 0.937017 & -0.109336 \end{pmatrix}$
2	0.613709	0.686767	-0.320779	$\begin{pmatrix} 0.363756 & -0.233987 & -0.901627 \\ 0.870423 & -0.259326 & 0.418466 \\ -0.331731 & -0.937017 & 0.109336 \end{pmatrix}$

# JS07: Augmented Truncated Cube



## Model Parameters

Model file: Augmented\_Truncated\_Cube.ply  
 Sphericity: 0.63827  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.40619  
 Oriented-bounding-box lower bound to the MPF: 0.85433

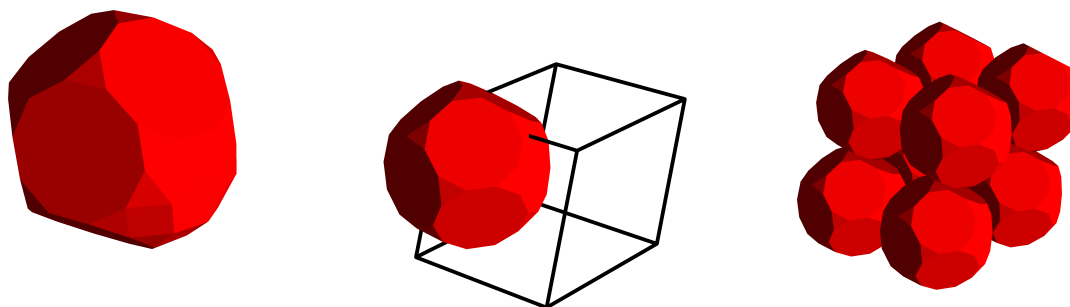
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.96347  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  
 $\mathbf{v1} = \{0.967392, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.825376, 2.310030, -0.000000\}$   
 $\mathbf{v3} = \{0.825376, 2.039880, 0.928907\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.935432	2.303830	0.054537	$\begin{pmatrix} -1.000000 & 0.000257 & -0.000883 \\ 0.000919 & 0.279254 & -0.960217 \\ 0.000000 & -0.960217 & -0.279254 \end{pmatrix}$
2	0.451736	1.110000	0.211080	$\begin{pmatrix} 1.000000 & -0.000257 & 0.000883 \\ 0.000919 & 0.279254 & -0.960217 \\ 0.000000 & 0.960217 & 0.279254 \end{pmatrix}$

# JS08: Augmented Truncated Dodecahedron



## Model Parameters

Model file:	Augmented_Truncated_Dodecahedron.ply
Sphericity:	0.81740
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.54646
Oriented-bounding-box lower bound to the MPF:	0.51399

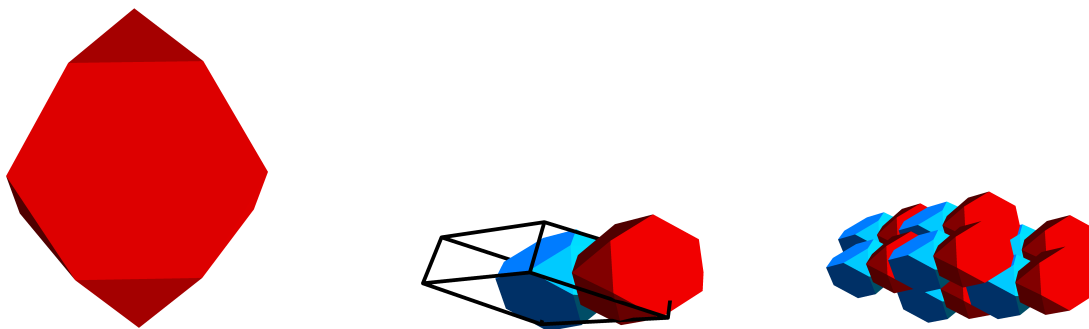
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.87969
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.162160, -0.000000, -0.000000\}$ $\mathbf{v2} = \{0.446949, 1.053600, 0.000000\}$ $\mathbf{v3} = \{0.132057, -0.719415, -0.928389\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.242829	-0.078722	-0.361842	$\begin{pmatrix} -0.916282 & 0.400190 & 0.016577 \\ -0.352198 & -0.785309 & -0.509163 \\ -0.190743 & -0.472376 & 0.860510 \end{pmatrix}$

# JS09: Augmented Truncated Tetrahedron



## Model Parameters

Model file:	Augmented_Truncated_Tetrahedron.ply
Sphericity:	0.57344
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.27695
Oriented-bounding-box lower bound to the MPF:	0.57813

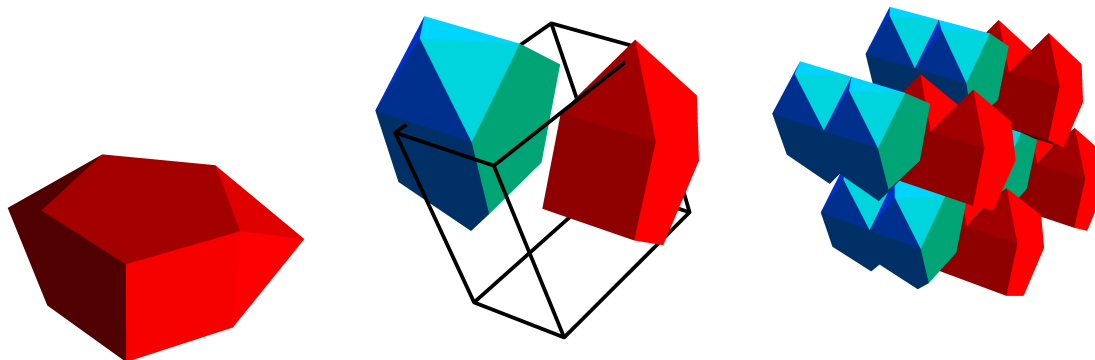
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.90795
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.864630, -0.000000, -0.000000\}$ $\mathbf{v2} = \{0.368525, -1.051640, 0.000000\}$ $\mathbf{v3} = \{1.918300, -0.381119, 1.123330\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	2.348600	-0.660880	0.544229	$\begin{pmatrix} -0.415859 & 0.878319 & 0.235832 \\ 0.059498 & 0.285040 & -0.956667 \\ -0.907481 & -0.383807 & -0.170795 \end{pmatrix}$
2	3.431870	-0.810898	1.115630	$\begin{pmatrix} -0.259457 & 0.192308 & 0.946414 \\ 0.330396 & -0.903166 & 0.274097 \\ 0.907481 & 0.383807 & 0.170795 \end{pmatrix}$

# JS10: Biaugmented Pentagonal Prism



## Model Parameters

Model file:	Biaugmented_Pentagonal_Prism.ply
Sphericity:	0.37650
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.16543
Oriented-bounding-box lower bound to the MPF:	0.56196

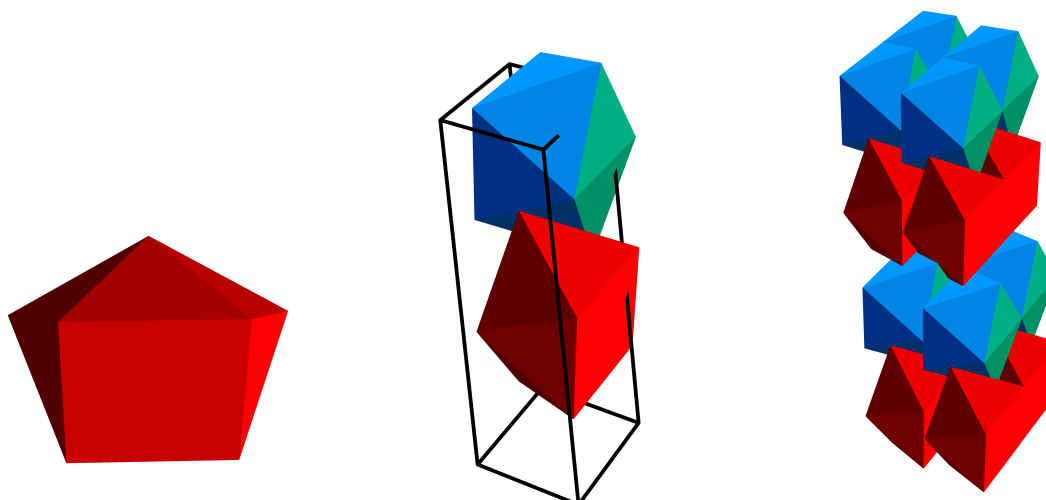
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.90677
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.769829, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.242912, -1.762170, 0.000000\}$ $\mathbf{v3} = \{0.384914, 0.273997, -1.625880\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.080237	-1.106200	-0.207249	$\begin{pmatrix} 0.000000 & 0.073831 & 0.997271 \\ 0.000000 & -0.997271 & 0.073831 \\ 1.000000 & 0.000000 & -0.000000 \end{pmatrix}$
2	0.768097	-0.171565	-0.910335	$\begin{pmatrix} -0.000000 & -0.073831 & -0.997271 \\ -0.000000 & 0.997271 & -0.073831 \\ 1.000000 & 0.000000 & -0.000000 \end{pmatrix}$

# JS11: Biaugmented Triangular Prism



## Model Parameters

Model file:	Biaugmented_Triangular_Prism.ply
Sphericity:	0.48294
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.22322
Oriented-bounding-box lower bound to the MPF:	0.60549

## Unit Cell Parameters

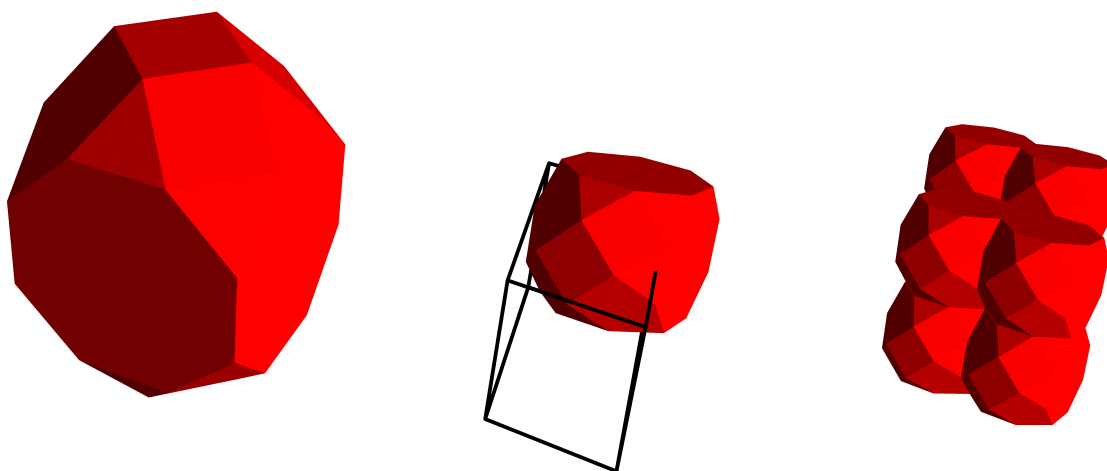
Number of particles:	2
Maximum packing fraction (MPF):	0.91501
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.895892, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.019875, 1.033870, -0.000000\}$ $\mathbf{v3} = \{-0.863296, 1.030500, 2.359810\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.191226	1.609830	1.973710	$\begin{pmatrix} -0.514569 & 0.013555 & -0.857342 \\ 0.857131 & -0.019068 & -0.514745 \\ -0.023325 & -0.999726 & -0.001807 \\ 0.485013 & -0.009736 & -0.874453 \\ -0.874196 & 0.021273 & -0.485107 \\ 0.023325 & 0.999726 & 0.001807 \end{pmatrix}$
2	0.154461	1.086870	0.795572	



# JS12: Biaugmented Truncated Cube



## Model Parameters

Model file:	Biaugmented.Truncated.Cube.ply
Sphericity:	0.59153
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.36374
Oriented-bounding-box lower bound to the MPF:	0.78361

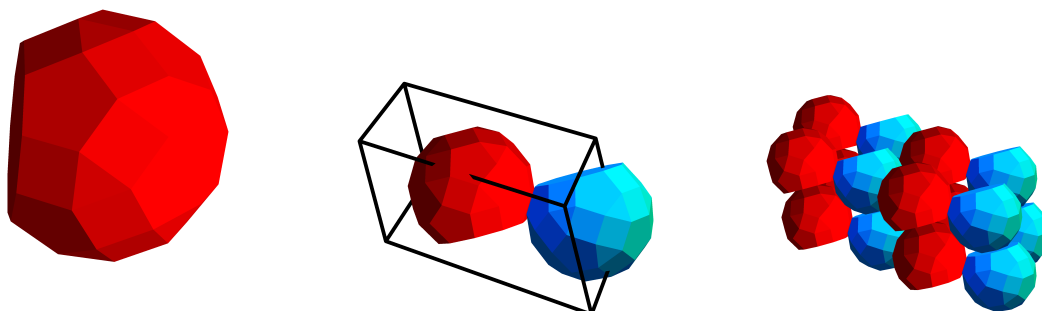
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.96102
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{0.930159, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.467953, 1.292260, -0.000000\}$ $\mathbf{v3} = \{-0.000069, 0.340469, 0.865698\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.304615	1.301210	0.671645	$\begin{pmatrix} 0.000044 & -0.352564 & -0.935788 \\ -0.999986 & -0.004891 & 0.001795 \\ -0.005210 & 0.935775 & -0.352560 \end{pmatrix}$

# JS13: Bigyrate Diminished Rhombicosidodecahedron



## Model Parameters

Model file:	Bigyrate_Diminished_Rhombicosidodecahedron.ply
Sphericity:	0.80687
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.62385
Oriented-bounding-box lower bound to the MPF:	0.58749

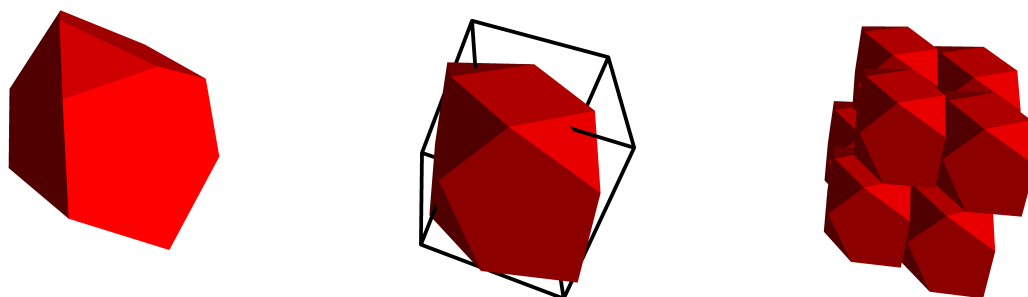
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.81863
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.322580, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.222159, 1.194920, -0.000000\}$ $\mathbf{v3} = \{-0.481224, 0.343403, 0.880296\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.825440	1.061060	0.203451	$\begin{pmatrix} 0.697709 & 0.204344 & -0.686619 \\ -0.352305 & -0.736669 & -0.577235 \\ -0.623766 & 0.644641 & -0.441989 \\ -0.082102 & -0.078879 & 0.993498 \\ -0.872767 & 0.486988 & -0.033461 \\ -0.481182 & -0.869839 & -0.108826 \end{pmatrix}$
2	0.601705	0.717608	0.466453	

# JS14: Bilunabirotanda



## Model Parameters

Model file:	Bilunabirotanda.ply
Sphericity:	0.49112
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.19876
Oriented-bounding-box lower bound to the MPF:	0.62377

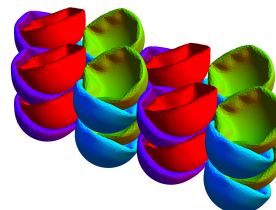
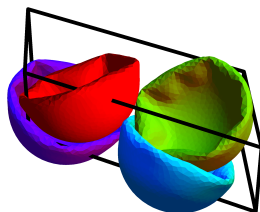
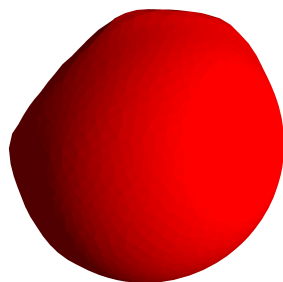
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.95273
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.109550, -0.000000, -0.000000\}$ $\mathbf{v2} = \{0.577240, -0.913529, 0.000000\}$ $\mathbf{v3} = \{-0.240277, -0.419320, -1.035510\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.785507	-0.876971	-0.484565	$\begin{pmatrix} -0.158705 & 0.804588 & 0.572233 \\ 0.848365 & -0.185353 & 0.495905 \\ 0.505064 & 0.564165 & -0.653168 \end{pmatrix}$

# PA01: Cap



## Model Parameters

Model file:	Cap.ply
Sphericity:	0.155754
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.18253
Oriented-bounding-box lower bound to the MPF:	0.27282

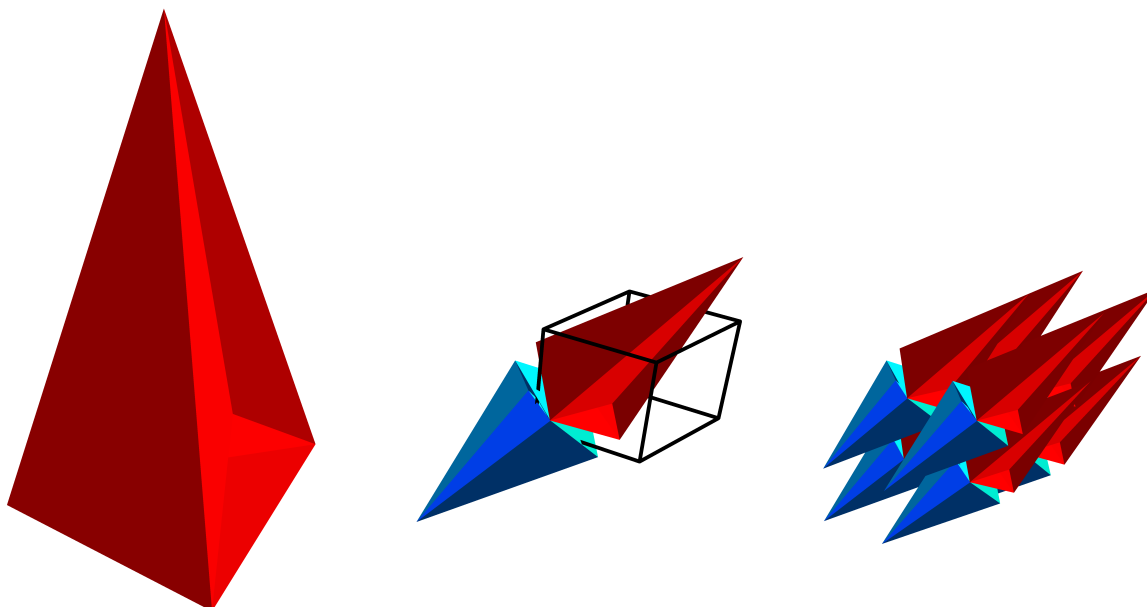
## Unit Cell Parameters

Number of particles:	4
Maximum packing fraction (MPF):	0.51850
Particles form a centrosymmetric compound (y/n/-):	n
Lattice Vectors:	$\mathbf{v1} = \{3.917210, -0.000000, -0.000000\}$ $\mathbf{v2} = \{0.976347, -1.629120, -0.000000\}$ $\mathbf{v3} = \{-0.007660, 0.027530, -1.208860\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	3.618090	-0.989743	-0.386380	$\begin{pmatrix} 0.484498 & 0.804254 & -0.344147 \\ 0.394775 & 0.150054 & 0.906441 \\ 0.780650 & -0.575030 & -0.244799 \end{pmatrix}$
2	3.444920	-1.478610	-0.990058	$\begin{pmatrix} -0.541333 & -0.742932 & -0.393714 \\ -0.498073 & -0.093914 & 0.862035 \\ -0.677408 & 0.662746 & -0.319195 \end{pmatrix}$
3	1.335820	-1.183670	-1.000530	$\begin{pmatrix} -0.408871 & -0.550281 & -0.728022 \\ 0.000185 & -0.797801 & 0.602920 \\ -0.912592 & 0.246382 & 0.326299 \end{pmatrix}$
4	1.836070	-1.293040	-0.383488	$\begin{pmatrix} 0.309943 & -0.700558 & -0.642770 \\ -0.489792 & -0.697102 & 0.523596 \\ -0.814886 & 0.152538 & -0.559190 \end{pmatrix}$

# PH01: Császár Polyhedron



## Model Parameters

Model file:	Csaszar_Polyhedron.ply
Sphericity:	0.17469
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.04157
Oriented-bounding-box lower bound to the MPF:	0.23149

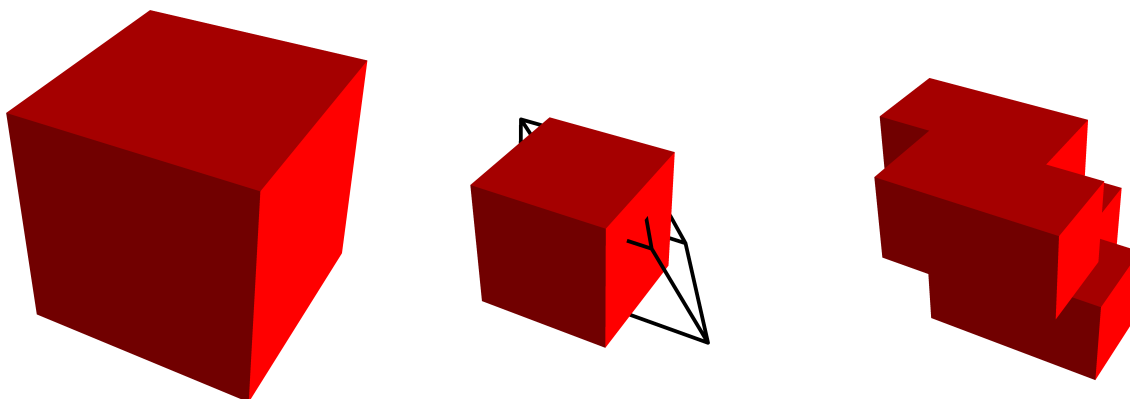
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.61327
Particles form a centrosymmetric compound (y/n/-):	n
Lattice Vectors:	$\mathbf{v1} = \{1.545610, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.537367, 1.338010, -0.000000\}$ $\mathbf{v3} = \{0.159014, -0.004357, 1.588930\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.333401	0.299867	0.358312	$\begin{pmatrix} -0.380148 & -0.632100 & 0.675231 \\ -0.689016 & 0.680563 & 0.249182 \\ -0.617045 & -0.370519 & -0.694241 \end{pmatrix}$
2	0.328758	0.292475	0.364067	$\begin{pmatrix} 0.690331 & -0.679820 & -0.247565 \\ 0.381664 & 0.632880 & -0.673643 \\ 0.614635 & 0.370550 & 0.696359 \end{pmatrix}$

# RP04: Cube



## Model Parameters

Model file: Cube.ply  
 Sphericity: 0.57734  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.27216  
 Oriented-bounding-box lower bound to the MPF: 1.00000

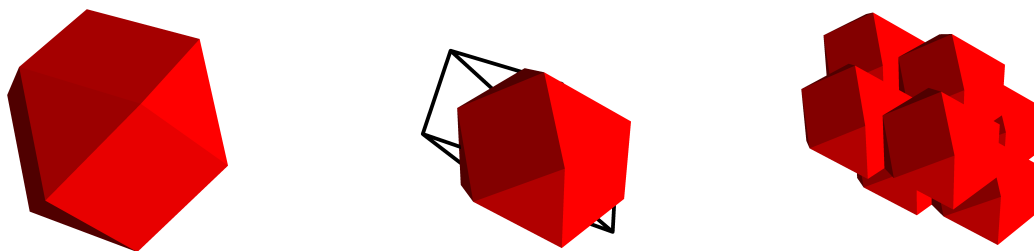
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 1.00000  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.000000, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.628444, -1.000000, 0.000000\}$   
 $\mathbf{v3} = \{0.308379, 0.368947, -1.000000\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.952185	-0.797273	-0.207280	$\begin{pmatrix} -1.000000 & -0.000000 & 0.000000 \\ -0.000000 & 1.000000 & -0.000000 \\ -0.000000 & -0.000000 & -1.000000 \end{pmatrix}$

# AS11: Cuboctahedron



## Model Parameters

Model file: Cuboctahedron.ply  
 Sphericity: 0.70710  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.41666  
 Oriented-bounding-box lower bound to the MPF: 0.83333

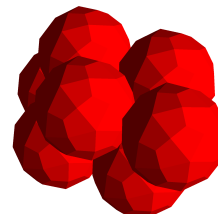
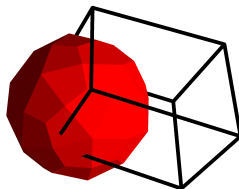
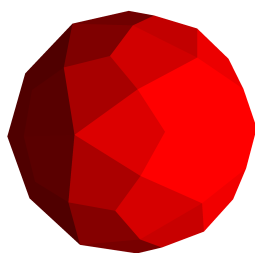
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.91836  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.096110, -0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.455940, -1.139320, 0.000000\}$   
 $\mathbf{v3} = \{0.317390, 0.569141, -0.872086\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.349980	-0.840179	-0.073449	$\begin{pmatrix} 0.807868 & 0.309165 & -0.501763 \\ 0.563182 & -0.655894 & 0.502622 \\ -0.173710 & -0.688636 & -0.703992 \end{pmatrix}$

# CS01: Deltoidal Hexecontahedron



## Model Parameters

Model file: Deltoidal\_Hexecontahedron.ply  
 Sphericity: 0.92459  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 0.78287  
 Outscribed-sphere lower bound to the MPF: 0.61878  
 Oriented-bounding-box lower bound to the MPF: 0.53980

## Unit Cell Parameters

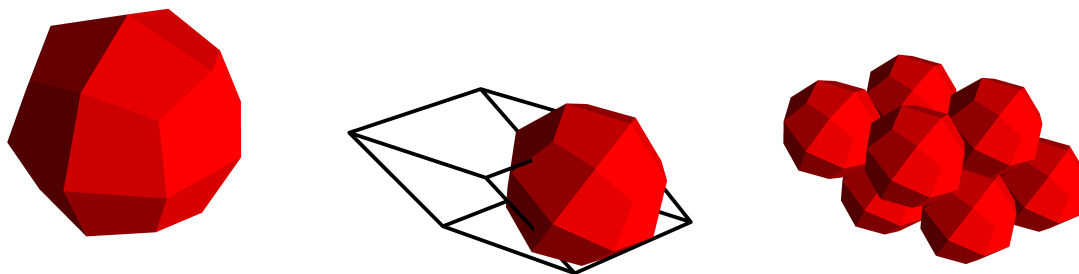
Number of particles: 1  
 Maximum packing fraction (MPF): 0.77155  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.227240, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.609924, -1.065260, 0.000000\}$   
 $\mathbf{v3} = \{0.614728, -0.356003, 0.991404\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.574648	-0.579011	0.081752	$\begin{pmatrix} -0.199891 & 0.979761 & -0.010544 \\ -0.918497 & -0.191117 & -0.346176 \\ -0.341185 & -0.059513 & 0.938110 \end{pmatrix}$



# CS02: Deltoidal Icositetrahedron



## Model Parameters

Model file:	Deltoidal_Icositetrahedron.ply
Sphericity:	0.86285
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.85134
Outscribed-sphere lower bound to the MPF:	0.54691
Oriented-bounding-box lower bound to the MPF:	0.54525

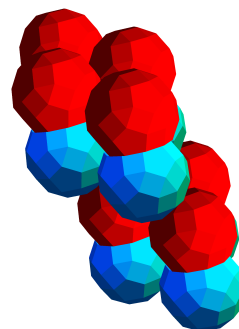
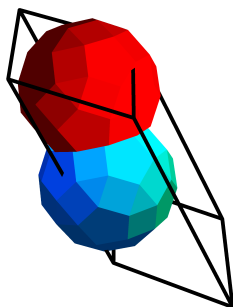
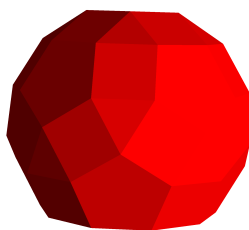
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.79693
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.232570, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.574234, -1.042450, -0.000000\}$ $\mathbf{v3} = \{0.577691, 0.361651, -0.976589\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.105560	-0.280421	-0.400859	$\begin{pmatrix} -0.888107 & -0.018639 & 0.459258 \\ -0.449811 & -0.170239 & -0.876749 \\ 0.094526 & -0.985226 & 0.142807 \end{pmatrix}$

# JS15: Diminished Rhombicosidodecahedron



## Model Parameters

Model file:	Diminished_Rhombicosidodecahedron.ply
Sphericity:	0.80687
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.62385
Oriented-bounding-box lower bound to the MPF:	0.57791

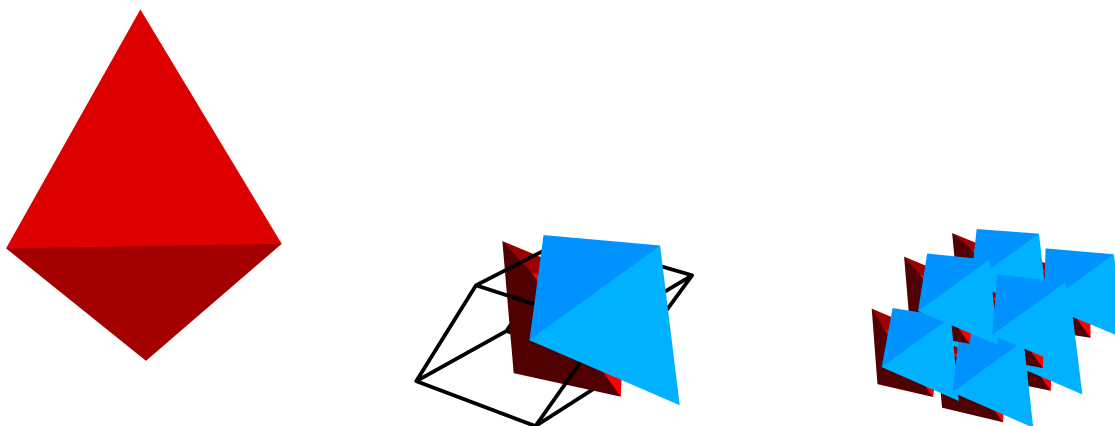
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.82232
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.217830, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.579640, 1.070240, -0.000000\}$ $\mathbf{v3} = \{-0.920033, -0.178179, 1.866040\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.247484	0.362774	0.577885	$\begin{pmatrix} -0.446289 & 0.872033 & -0.200957 \\ 0.888926 & 0.406114 & -0.211853 \\ -0.103131 & -0.273184 & -0.956418 \\ -0.660927 & -0.669113 & -0.339799 \\ 0.228944 & -0.610987 & 0.757812 \\ -0.714675 & 0.423064 & 0.557007 \end{pmatrix}$
2	-0.559601	0.548416	1.506450	

# JS16: Dipyramid 3



## Model Parameters

Model file:	Dipyramid.3.ply
Sphericity:	0.33333
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.07654
Oriented-bounding-box lower bound to the MPF:	0.29003

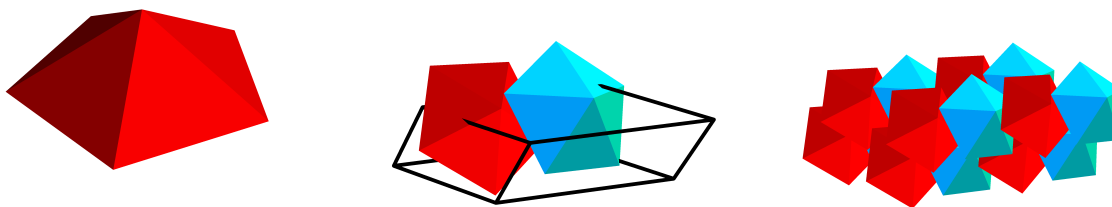
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.85634
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.551920, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.398965, -1.273020, 0.000000\}$ $\mathbf{v3} = \{0.557981, 0.500335, 1.182960\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.569650	-0.458744	1.090100	$\begin{pmatrix} 0.050767 & 0.487599 & -0.871591 \\ -0.524267 & -0.729790 & -0.438807 \\ -0.850040 & 0.479223 & 0.218583 \end{pmatrix}$
2	0.731063	-0.029580	0.525376	

# JS17: Dipyramid 5



## Model Parameters

Model file:	Dipyramid.5.ply
Sphericity:	0.49112
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.17317
Oriented-bounding-box lower bound to the MPF:	0.32759

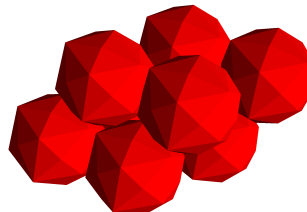
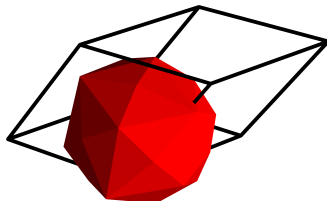
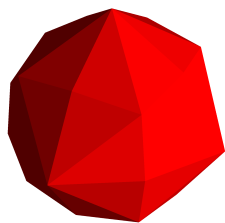
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.84024
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.623260, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-1.838130, -1.559930, 0.000000\}$ $\mathbf{v3} = \{0.380888, 0.261803, 0.940004\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.102482	-0.085377	0.642527	$\begin{pmatrix} -0.519419 & 0.543119 & 0.659716 \\ 0.539629 & 0.807095 & -0.239581 \\ -0.662574 & 0.231559 & -0.712303 \end{pmatrix}$
2	-0.829158	-0.874837	0.649843	$\begin{pmatrix} -0.737405 & -0.035006 & 0.674544 \\ 0.131262 & 0.972191 & 0.193947 \\ -0.662574 & 0.231559 & -0.712303 \end{pmatrix}$

# CS03: Disdyakis Dodecahedron



## Model Parameters

Model file: Disdyakis\_Dodecahedron.ply  
 Sphericity: 0.82594  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 0.81365  
 Outscribed-sphere lower bound to the MPF: 0.45844  
 Oriented-bounding-box lower bound to the MPF: 0.54603

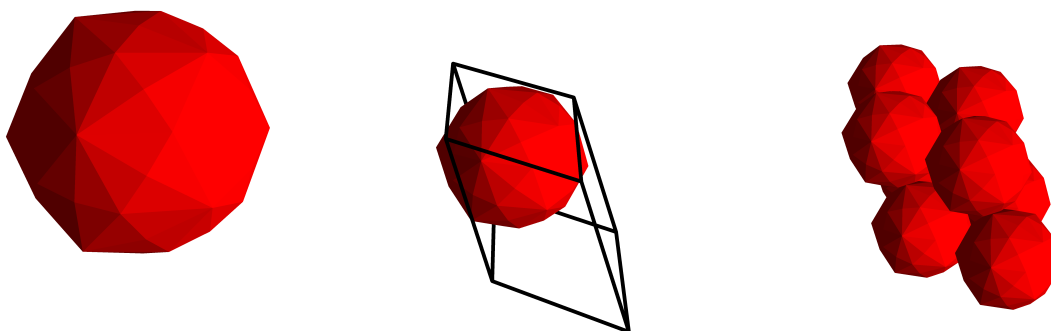
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.79328  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.220040, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-0.600839, -1.046660, 0.000000\}$   
 $\mathbf{v3} = \{-0.597177, -0.344754, -0.987164\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.018363	-1.121350	-0.630366	$\begin{pmatrix} 0.780015 & -0.122660 & 0.613621 \\ 0.619960 & 0.284683 & -0.731167 \\ -0.085002 & 0.950742 & 0.298101 \end{pmatrix}$

# CS04: Disdyakis Triacontahedron



## Model Parameters

Model file:	Disdyakis_Triacontahedron.ply
Sphericity:	0.90494
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.77313
Outscribed-sphere lower bound to the MPF:	0.57295
Oriented-bounding-box lower bound to the MPF:	0.54354

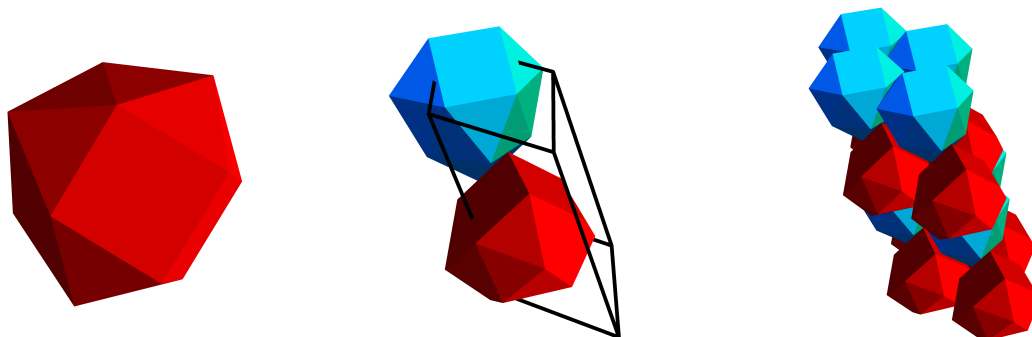
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.76549
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.230230, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.605036, -1.064070, -0.000000\}$ $\mathbf{v3} = \{0.617062, -0.356740, -0.997930\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.849457	-0.409026	-0.498821	$\begin{pmatrix} 0.467012 & 0.797017 & -0.382967 \\ 0.877234 & -0.363146 & 0.313984 \\ 0.111178 & -0.482585 & -0.868764 \end{pmatrix}$

# JS18: Disphenocingulum



## Model Parameters

Model file:	Disphenocingulum.ply
Sphericity:	0.69884
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.37476
Oriented-bounding-box lower bound to the MPF:	0.53256

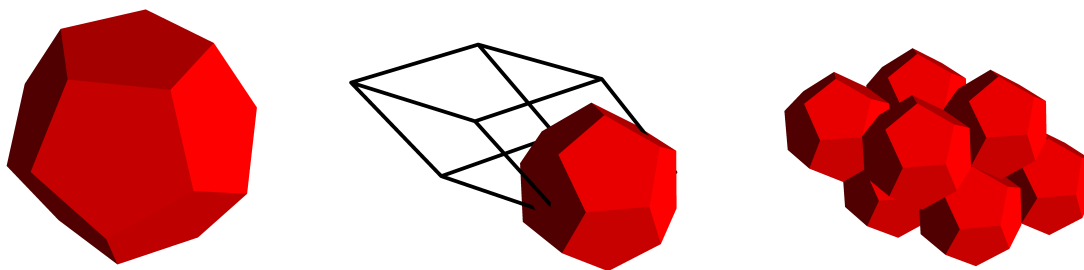
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.85870
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.150920, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.562192, -1.096430, 0.000000\}$ $\mathbf{v3} = \{-0.609043, -0.138161, 1.845690\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.217034	-0.331043	1.424930	$\begin{pmatrix} -0.500092 & -0.180507 & -0.846951 \\ -0.864814 & 0.053528 & 0.499231 \\ -0.044779 & 0.982116 & -0.182874 \end{pmatrix}$
2	0.586851	-0.817846	0.504983	$\begin{pmatrix} 0.172152 & 0.505156 & 0.845684 \\ -0.060294 & 0.862295 & -0.502804 \\ -0.983223 & 0.035569 & 0.178903 \end{pmatrix}$

# PS03: Dodecahedron



## Model Parameters

Model file:	Dodecahedron.ply
Sphericity:	0.79465
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.98116
Outscribed-sphere lower bound to the MPF:	0.49235
Oriented-bounding-box lower bound to the MPF:	0.47745

## Unit Cell Parameters

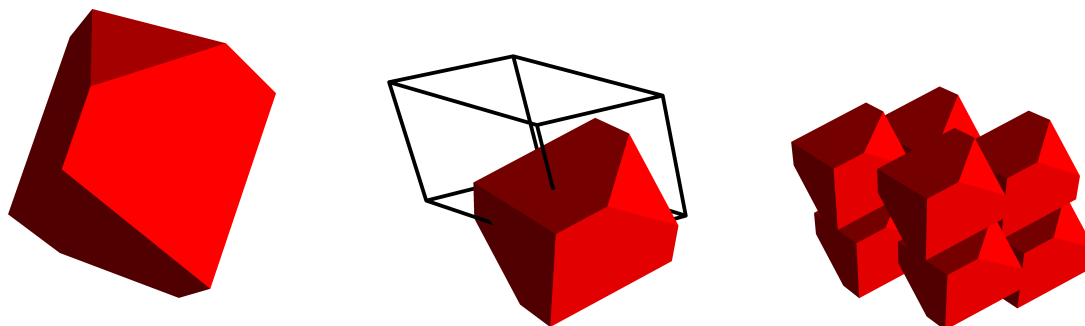
Number of particles:	1
Maximum packing fraction (MPF):	0.90450
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.157920, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.585019, -1.006590, 0.000000\}$ $\mathbf{v3} = \{0.584984, 0.333004, -0.948848\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.275100	-0.203666	-0.907594	$\begin{pmatrix} -0.366816 & 0.908579 & -0.199827 \\ -0.714299 & -0.412690 & -0.565211 \\ -0.596005 & -0.064592 & 0.800378 \end{pmatrix}$



# MS01: Dürer's Solid



## Model Parameters

Model file:	Duerers_Solid.ply
Sphericity:	0.59880
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.31151
Oriented-bounding-box lower bound to the MPF:	0.60300

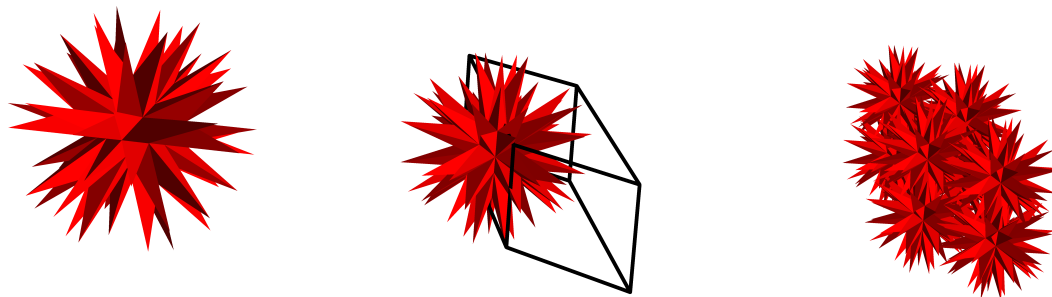
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.98926
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.275840, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.628505, -0.805168, 0.000000\}$ $\mathbf{v3} = \{0.292993, -0.045210, -0.984029\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.842540	-0.578469	-0.950785	$\begin{pmatrix} -0.227328 & 0.960657 & 0.159565 \\ 0.640770 & 0.270945 & -0.718333 \\ -0.733305 & -0.061053 & -0.677153 \end{pmatrix}$

# PH02: Echidnahedron



## Model Parameters

Model file: Echidnahedron.ply  
 Sphericity: 0.26640  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.07659  
 Oriented-bounding-box lower bound to the MPF: 0.06269

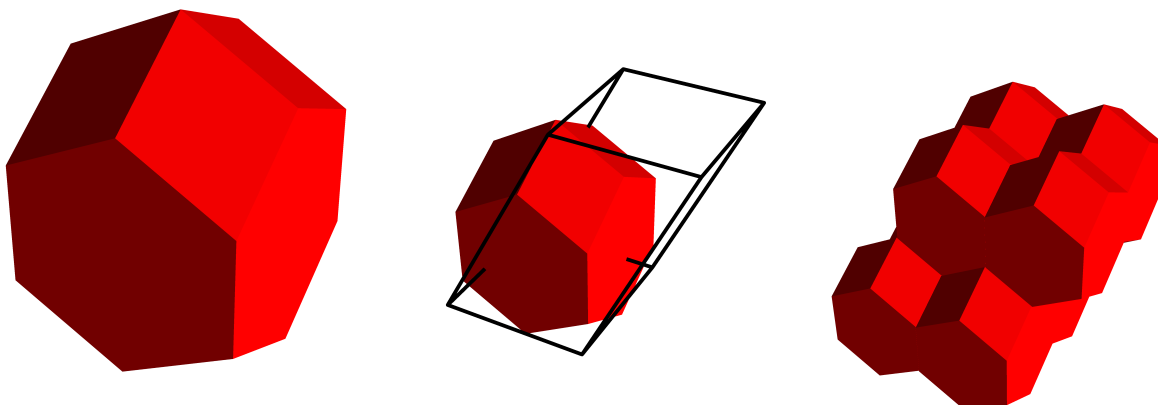
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.29477  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.750490, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-1.672940, 1.653630, -0.000000\}$   
 $\mathbf{v3} = \{-0.219573, 0.609904, 1.171960\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.726819	0.990412	0.706610	$\begin{pmatrix} 0.717364 & 0.690760 & 0.090777 \\ -0.606275 & 0.554742 & 0.569818 \\ 0.343250 & -0.463803 & 0.816742 \end{pmatrix}$

# MS02: Elongated Dodecahedron



## Model Parameters

Model file:	Elongated_Dodecahedron.ply
Sphericity:	0.57734
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.31426
Oriented-bounding-box lower bound to the MPF:	0.66666

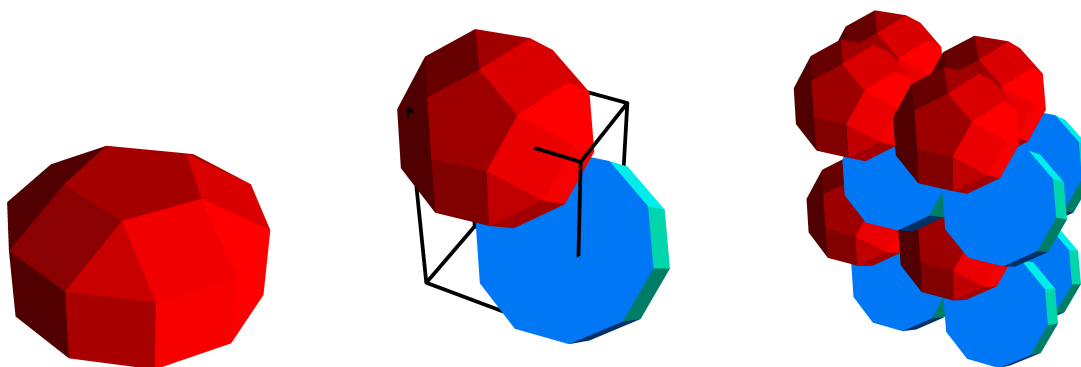
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	1.00000
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{0.953225, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.000004, 0.953184, -0.000000\}$ $\mathbf{v3} = \{0.474064, 0.476465, 1.100670\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.293759	0.883224	0.124414	$\begin{pmatrix} -0.999957 & 0.000475 & -0.009272 \\ 0.000470 & 1.000000 & 0.000452 \\ 0.009272 & 0.000447 & -0.999957 \end{pmatrix}$

# JS19: Elongated Pentagonal Cupola



## Model Parameters

Model file:	Elongated_Pentagonal_Cupola.ply
Sphericity:	0.45045
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.36461
Oriented-bounding-box lower bound to the MPF:	0.65928

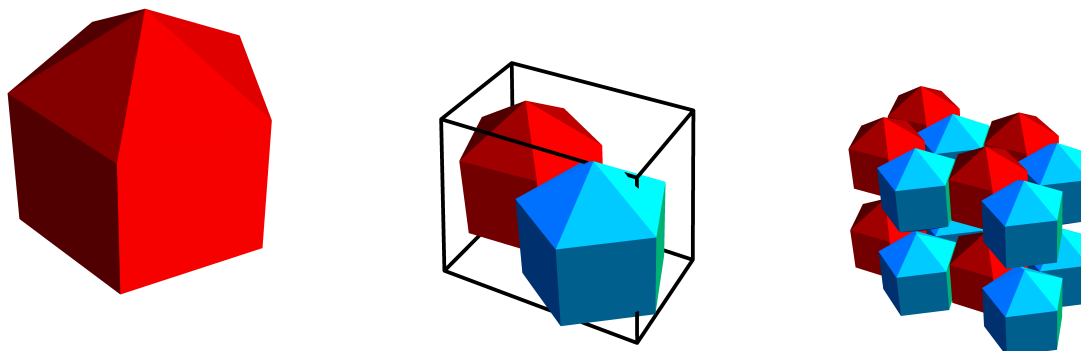
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.83541
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.467490, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.040260, -0.884982, 0.000000\}$ $\mathbf{v3} = \{0.043533, -0.110004, 1.844560\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.377610	-0.684371	0.779169	$\begin{pmatrix} 0.520681 & 0.513508 & 0.682056 \\ 0.853749 & -0.311258 & -0.417411 \\ -0.002049 & 0.799642 & -0.600473 \end{pmatrix}$
2	0.665674	-0.754561	1.712850	$\begin{pmatrix} 0.651064 & -0.454706 & -0.607748 \\ 0.759020 & 0.392192 & 0.519687 \\ 0.002049 & -0.799642 & 0.600473 \end{pmatrix}$

# JS20: Elongated Pentagonal Dipyramid



## Model Parameters

Model file:	Elongated_Pentagonal_Dipyramid.ply
Sphericity:	0.67091
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.38059
Oriented-bounding-box lower bound to the MPF:	0.46158

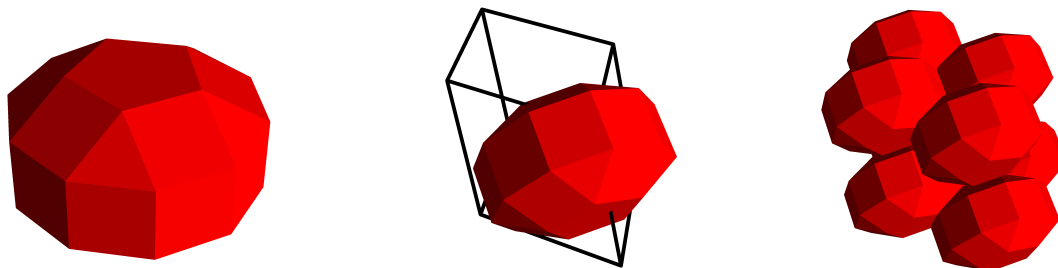
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.83751
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.835190, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.000856, 1.161860, -0.000000\}$ $\mathbf{v3} = \{-0.328190, 0.581506, 1.119970\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.265370	0.388413	0.521285	$\begin{pmatrix} 0.950459 & -0.306318 & 0.052881 \\ 0.306029 & 0.951924 & 0.013685 \\ -0.054530 & 0.003176 & 0.998507 \end{pmatrix}$
2	0.346916	0.931441	0.523382	$\begin{pmatrix} 0.948817 & 0.311710 & 0.050825 \\ 0.311083 & -0.950172 & 0.020011 \\ 0.054530 & -0.003176 & -0.998507 \end{pmatrix}$

# JS21: Elongated Pentagonal Gyrobicupola



## Model Parameters

Model file:	Elongated_Pentagonal_Gyrobicupola.ply
Sphericity:	0.60567
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.44920
Oriented-bounding-box lower bound to the MPF:	0.60407

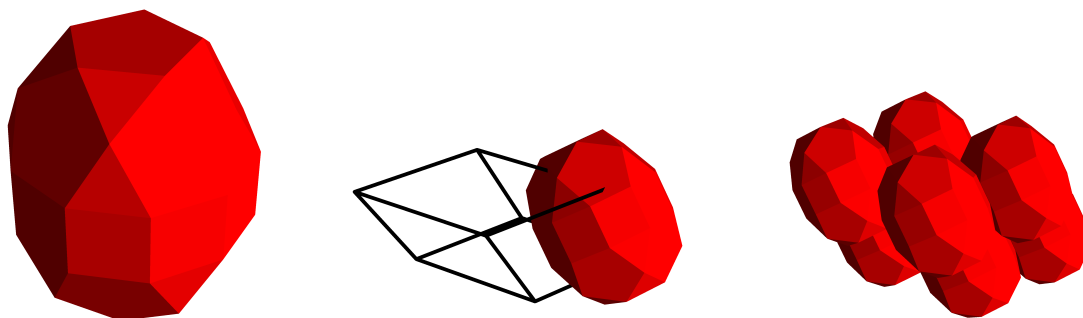
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.79475
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.173270, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.337863, 1.037880, 0.000000\}$ $\mathbf{v3} = \{-0.318557, 0.135441, 1.033290\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.661442	0.247635	0.572550	$\begin{pmatrix} -0.619214 & -0.784736 & 0.027631 \\ -0.413273 & 0.295778 & -0.861232 \\ 0.667667 & -0.544707 & -0.507460 \end{pmatrix}$

# JS22: Elongated Pentagonal Gyrobirotunda



## Model Parameters

Model file:	Elongated_Pentagonal_Gyrobirotunda.ply
Sphericity:	0.74693
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.43524
Oriented-bounding-box lower bound to the MPF:	0.57603

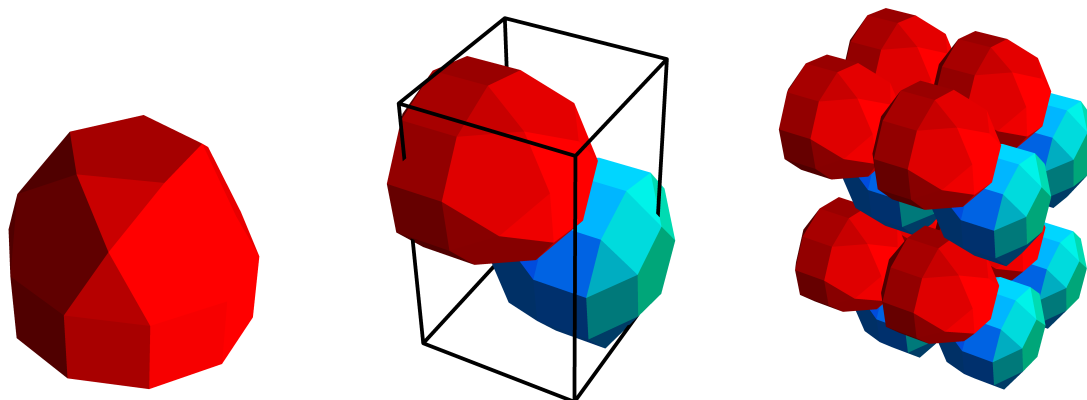
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.81918
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.192800, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.516967, 0.983087, -0.000000\}$ $\mathbf{v3} = \{0.090597, 0.579460, -1.041180\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.587020	1.222920	-0.483630	$\begin{pmatrix} -0.521914 & 0.617879 & -0.588074 \\ -0.601173 & -0.755539 & -0.260293 \\ -0.605143 & 0.217684 & 0.765778 \end{pmatrix}$

# JS23: Elongated Pentagonal Gyrocupolarotunda



## Model Parameters

Model file:	Elongated_Pentagonal_Gyrocupolarotunda.ply
Sphericity:	0.79010
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.51299
Oriented-bounding-box lower bound to the MPF:	0.58594

## Unit Cell Parameters

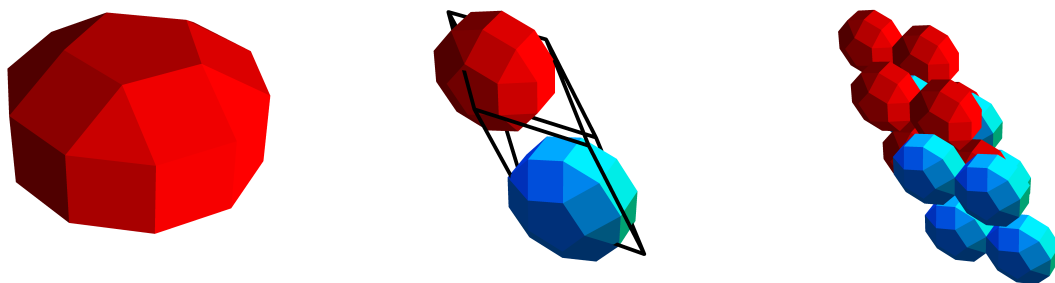
Number of particles:	2
Maximum packing fraction (MPF):	0.78374
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.130400, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.007012, -1.204550, -0.000000\}$ $\mathbf{v3} = \{-0.014247, -0.033135, 1.874120\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.652579	-0.127380	0.310587	$\begin{pmatrix} 0.013987 & 0.994854 & 0.100350 \\ 0.019241 & 0.100074 & -0.994794 \\ -0.999717 & 0.015845 & -0.017742 \\ 0.000006 & 0.746032 & 0.665910 \\ -0.023788 & -0.665722 & 0.745821 \\ 0.999717 & -0.015845 & 0.017742 \end{pmatrix}$
2	0.242482	-0.711082	1.213260	



# JS24: Elongated Pentagonal Orthobicupola



## Model Parameters

Model file:	Elongated_Pentagonal_Orthobicupola.ply
Sphericity:	0.60567
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.44920
Oriented-bounding-box lower bound to the MPF:	0.60407

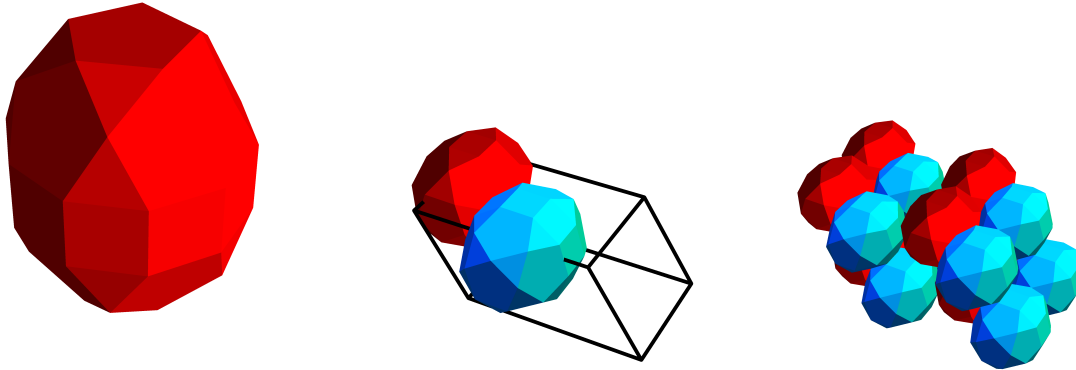
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.79329
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.331910, 0.000000, 0.000000\}$ $\mathbf{v2} = \{1.329290, -1.598230, 0.000000\}$ $\mathbf{v3} = \{0.675367, 0.017148, -1.184350\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	2.374360	-1.362030	-0.984889	$\begin{pmatrix} -0.815099 & 0.014228 & -0.579146 \\ -0.579221 & -0.038578 & 0.814257 \\ -0.010757 & 0.999154 & 0.039686 \end{pmatrix}$
2	0.969683	-0.573054	-0.232342	$\begin{pmatrix} 0.815099 & -0.014228 & 0.579146 \\ -0.579221 & -0.038578 & 0.814257 \\ 0.010757 & -0.999154 & -0.039686 \end{pmatrix}$

# JS25: Elongated Pentagonal Orthobirotunda



## Model Parameters

Model file:	Elongated_Pentagonal_Orthobirotunda.ply
Sphericity:	0.74693
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.43524
Oriented-bounding-box lower bound to the MPF:	0.57603

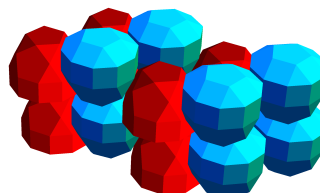
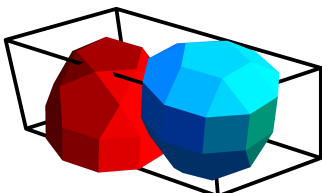
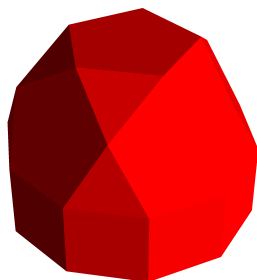
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.81243
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.984080, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.002824, 1.349050, -0.000000\}$ $\mathbf{v3} = \{-0.615163, 0.003002, 0.919711\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.585409	0.168215	0.762712	$\begin{pmatrix} 0.941641 & 0.010606 & -0.336451 \\ 0.336520 & -0.005570 & 0.941660 \\ 0.008113 & -0.999928 & -0.008814 \end{pmatrix}$
2	-0.416898	0.846103	0.781588	$\begin{pmatrix} 0.959605 & 0.005307 & 0.281299 \\ -0.281232 & -0.010740 & 0.959580 \\ 0.008113 & -0.999928 & -0.008814 \end{pmatrix}$

# JS26: Elongated Pentagonal Orthocupolarotunda



## Model Parameters

Model file:	Elongated_Pentagonal_Orthocupolarotunda.ply
Sphericity:	0.79010
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.51299
Oriented-bounding-box lower bound to the MPF:	0.58594

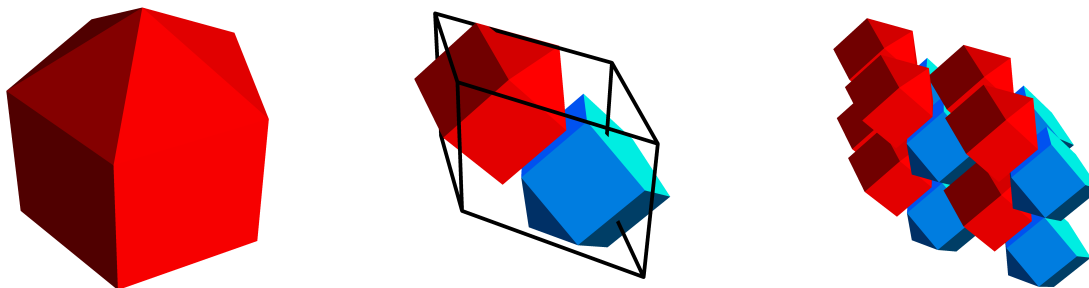
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.79266
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.202210, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.654309, 1.006200, -0.000000\}$ $\mathbf{v3} = \{0.068321, 0.106806, -1.138660\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	2.110130	0.174400	-0.170975	$\begin{pmatrix} -0.631951 & 0.774766 & -0.019408 \\ 0.774533 & 0.630487 & -0.050842 \\ -0.027154 & -0.047162 & -0.998518 \end{pmatrix}$
2	1.030950	0.206723	-0.578035	$\begin{pmatrix} 0.931908 & 0.360213 & -0.042356 \\ -0.361677 & 0.931677 & -0.034169 \\ 0.027154 & 0.047162 & 0.998518 \end{pmatrix}$

# JS27: Elongated Pentagonal Pyramid



## Model Parameters

Model file:	Elongated_Pentagonal_Pyramid.ply
Sphericity:	0.67555
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.35743
Oriented-bounding-box lower bound to the MPF:	0.53225

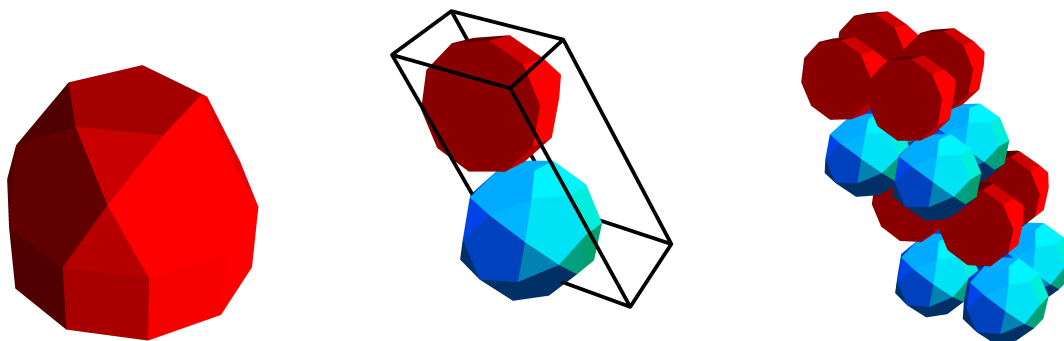
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.86656
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.833070, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.825819, 0.895328, -0.000000\}$ $\mathbf{v3} = \{-0.029652, -0.021731, -1.406270\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.824411	0.819012	-1.299110	$\begin{pmatrix} 0.657344 & -0.752898 & 0.032302 \\ -0.502446 & -0.405926 & 0.763395 \\ -0.561647 & -0.518043 & -0.645124 \end{pmatrix}$
2	-0.067136	0.784376	-0.634324	$\begin{pmatrix} 0.827133 & -0.370510 & -0.422580 \\ 0.020111 & 0.770944 & -0.636586 \\ 0.561647 & 0.518043 & 0.645124 \end{pmatrix}$

# JS28: Elongated Pentagonal Rotunda



## Model Parameters

Model file:	Elongated_Pentagonal_Rotunda.ply
Sphericity:	0.65993
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.44260
Oriented-bounding-box lower bound to the MPF:	0.61737

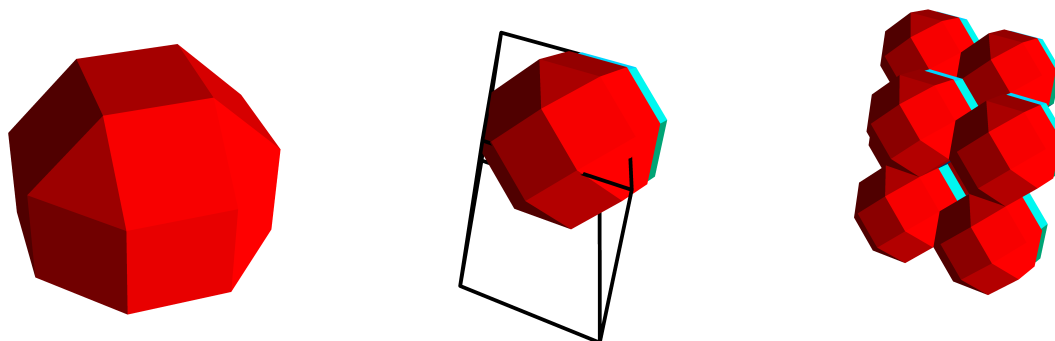
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.81652
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.259220, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.001838, 1.021120, 0.000000\}$ $\mathbf{v3} = \{-1.335180, 0.146308, 1.904940\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.041201	0.147590	0.294943	$\begin{pmatrix} 0.287043 & -0.293448 & -0.911863 \\ 0.957918 & 0.087932 & 0.273242 \\ -0.000000 & -0.951922 & 0.306339 \\ -0.330828 & -0.289090 & -0.898321 \\ -0.943691 & 0.101345 & 0.314922 \\ 0.000000 & 0.951922 & -0.306339 \end{pmatrix}$
2	-0.607242	0.846712	1.246400	

# JS29: Elongated Square Cupola



## Model Parameters

Model file:	Elongated_Square_Cupola.ply
Sphericity:	0.61012
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.43718
Oriented-bounding-box lower bound to the MPF:	0.68054

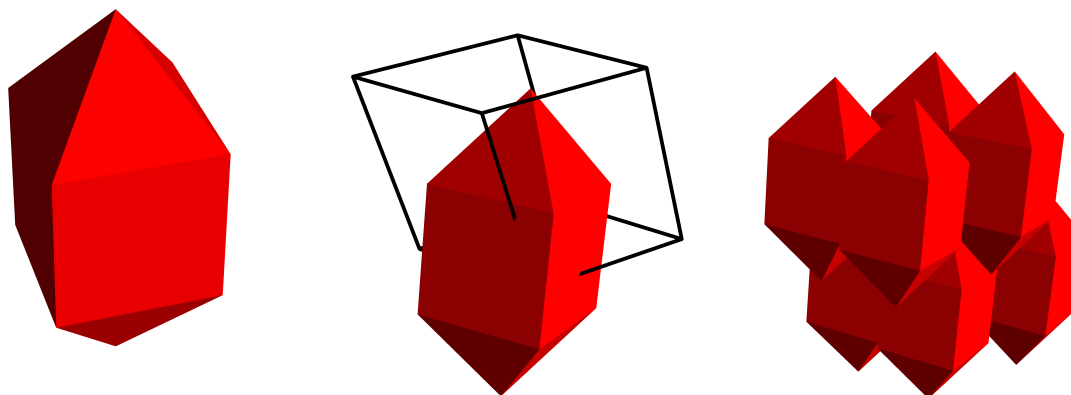
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.85746
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.276150, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.747597, 1.528610, 0.000000\}$ $\mathbf{v3} = \{-0.000048, -0.445865, -1.195680\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.371640	1.131740	-0.497365	$\begin{pmatrix} -0.999964 & 0.008076 & -0.002491 \\ 0.000471 & 0.347543 & 0.937664 \\ 0.008438 & 0.937629 & -0.347534 \end{pmatrix}$
2	0.479196	0.452219	-0.133516	$\begin{pmatrix} -0.000470 & -0.347431 & -0.937705 \\ 0.999963 & -0.008188 & 0.002532 \\ -0.008558 & -0.937670 & 0.347422 \end{pmatrix}$

# JS30: Elongated Square Dipyramid



## Model Parameters

Model file:	Elongated_Square_Dipyramid.ply
Sphericity:	0.41421
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.14788
Oriented-bounding-box lower bound to the MPF:	0.60947

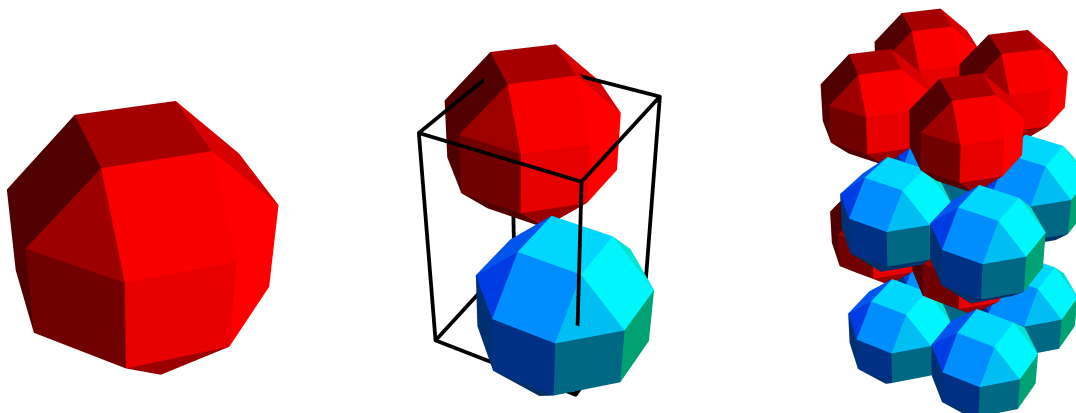
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.90995
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{0.881289, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.605767, 0.928714, -0.000000\}$ $\mathbf{v3} = \{-0.246957, -0.221909, 1.342700\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.614684	0.198400	0.092701	$\begin{pmatrix} -0.705433 & 0.653746 & -0.273825 \\ -0.705433 & -0.685075 & 0.181761 \\ -0.068765 & 0.321385 & 0.944448 \end{pmatrix}$

# JS31: Elongated Square Gyrobicupola



## Model Parameters

Model file:	Elongated_Square_Gyrobicupola.ply
Sphericity:	0.86285
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.87580
Outscribed-sphere lower bound to the MPF:	0.56262
Oriented-bounding-box lower bound to the MPF:	0.61928

## Unit Cell Parameters

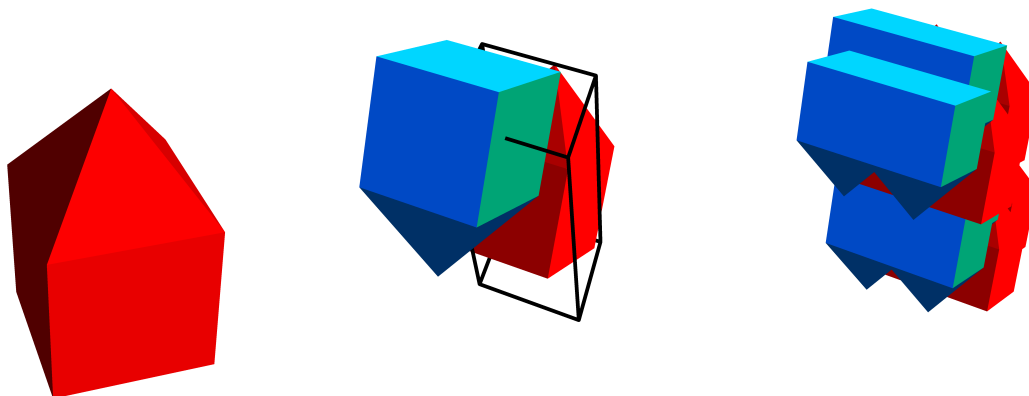
Number of particles:	2
Maximum packing fraction (MPF):	0.80639
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.173360, -0.000000, -0.000000\}$ $\mathbf{v2} = \{0.000141, 1.173240, 0.000000\}$ $\mathbf{v3} = \{0.006103, 0.002998, 1.801640\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.850398	0.423533	0.341698	$\begin{pmatrix} -0.710401 & -0.703601 & 0.016626 \\ 0.703616 & -0.710556 & -0.005911 \\ 0.015972 & 0.007499 & 0.999844 \\ 0.710401 & 0.703601 & -0.016626 \\ 0.703616 & -0.710556 & -0.005911 \\ -0.015972 & -0.007499 & -0.999844 \end{pmatrix}$
2	0.269924	1.013090	1.313630	



# JS32: Elongated Square Pyramid



## Model Parameters

Model file:	Elongated_Square_Pyramid.ply
Sphericity:	0.49999
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.21844
Oriented-bounding-box lower bound to the MPF:	0.72385

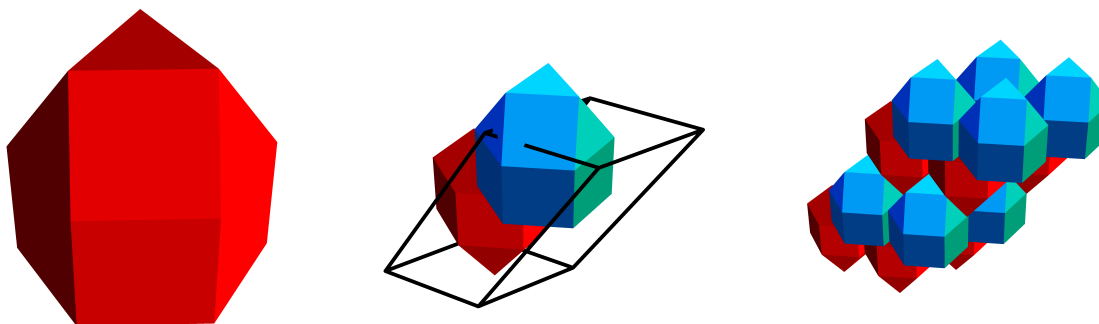
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.94371
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.931884, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.280764, 0.991905, -0.000000\}$ $\mathbf{v3} = \{-0.308767, 0.907578, -2.292750\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.004977	0.155895	-0.306202	$\begin{pmatrix} -0.707107 & 0.664320 & -0.242238 \\ 0.707107 & 0.664320 & -0.242238 \\ 0.000000 & -0.342577 & -0.939490 \\ 0.707107 & -0.664320 & 0.242239 \\ 0.707107 & 0.664320 & -0.242238 \\ -0.000000 & 0.342577 & 0.939490 \end{pmatrix}$
2	-0.090608	1.465140	-1.497420	

# JS33: Elongated Triangular Cupola



## Model Parameters

Model file:	Elongated_Triangular_Cupola.ply
Sphericity:	0.65935
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.35441
Oriented-bounding-box lower bound to the MPF:	0.60017

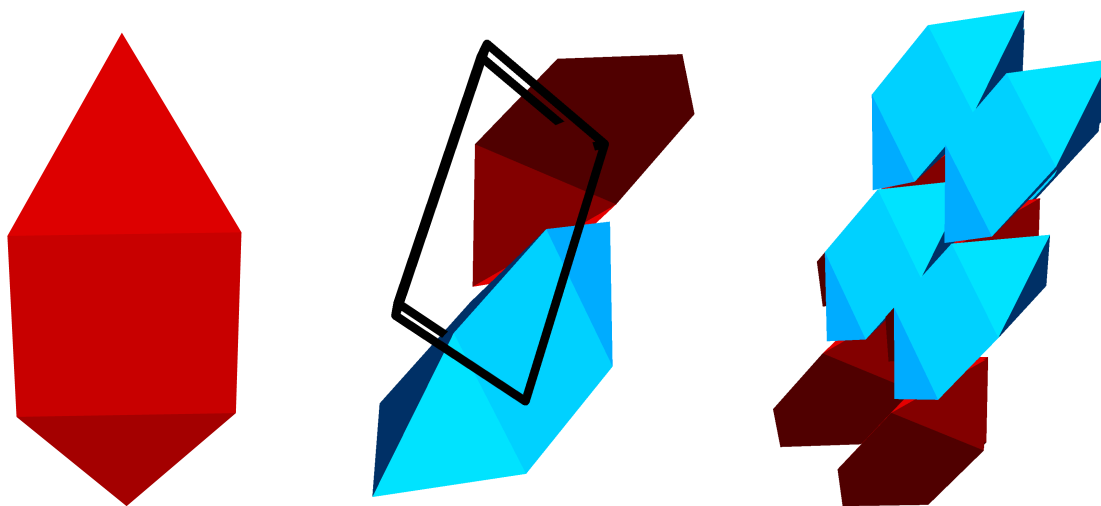
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.91258
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.121760, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.560880, 0.971473, -0.000000\}$ $\mathbf{v3} = \{1.190060, 0.130411, 2.011180\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.545290	0.582264	1.697710	$\begin{pmatrix} -0.608408 & -0.793624 & -0.000000 \\ 0.793624 & -0.608408 & -0.000000 \\ -0.000000 & -0.000000 & 1.000000 \end{pmatrix}$
2	0.916111	0.775677	0.732468	$\begin{pmatrix} 0.383095 & -0.923709 & -0.000000 \\ -0.923709 & -0.383095 & -0.000000 \\ 0.000000 & 0.000000 & -1.000000 \end{pmatrix}$

# JS34: Elongated Triangular Dipyramid



## Model Parameters

Model file:	Elongated_Triangular_Dipyramid.ply
Sphericity:	0.21927
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.05180
Oriented-bounding-box lower bound to the MPF:	0.29326

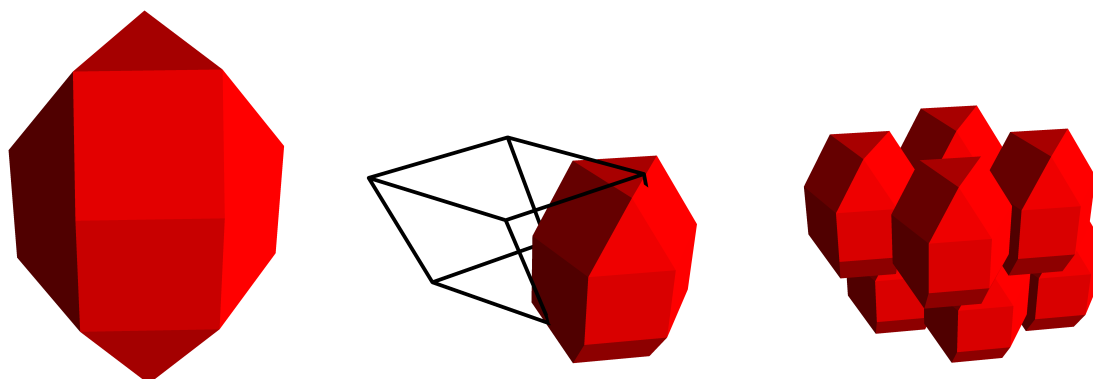
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.83284
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.880480, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.104895, 1.422200, -0.000000\}$ $\mathbf{v3} = \{-0.559520, 0.984683, -0.906294\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.297120	1.719230	-0.577689	$\begin{pmatrix} 0.390654 & 0.723944 & 0.568590 \\ -0.225825 & -0.523430 & 0.821599 \\ 0.892408 & -0.449363 & -0.040995 \\ -0.391106 & -0.723716 & -0.568569 \\ 0.225433 & 0.523627 & -0.821581 \\ 0.892309 & -0.449499 & -0.041644 \end{pmatrix}$
2	-0.488618	2.338670	-0.854420	

# JS35: Elongated Triangular Gyrobicupola



## Model Parameters

Model file:	Elongated_Triangular_Gyrobicupola.ply
Sphericity:	0.60243
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.29486
Oriented-bounding-box lower bound to the MPF:	0.62703

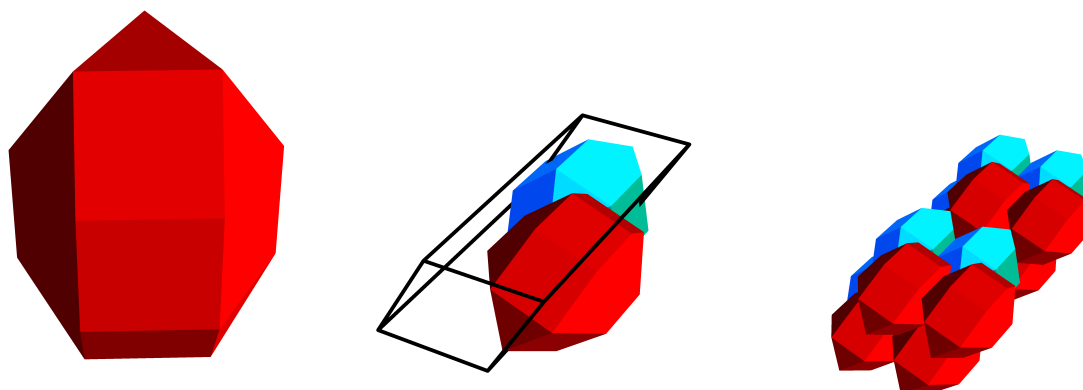
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.87941
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.025170, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.512803, -0.887684, 0.000000\}$ $\mathbf{v3} = \{-0.016363, 0.578489, -1.249550\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.808605	0.067190	-0.844779	$\begin{pmatrix} 0.991013 & 0.131844 & -0.022585 \\ 0.132065 & -0.991204 & 0.008578 \\ -0.021255 & -0.011484 & -0.999708 \end{pmatrix}$

# JS36: Elongated Triangular Orthobicupola



## Model Parameters

Model file:	Elongated_Triangular_Orthobicupola.ply
Sphericity:	0.60243
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.29486
Oriented-bounding-box lower bound to the MPF:	0.54326

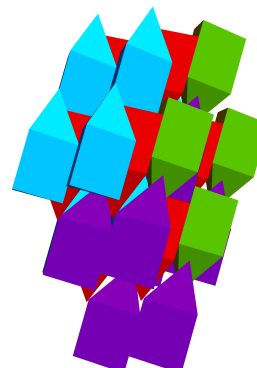
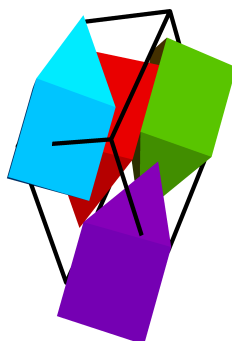
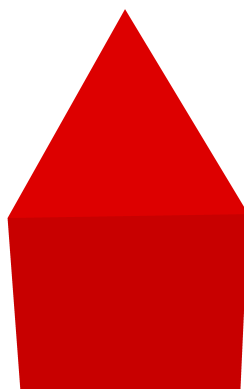
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.88043
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.030720, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.048971, -2.469210, 0.000000\}$ $\mathbf{v3} = \{0.514807, -0.012650, 0.892553\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.609735	-0.199664	0.009120	$\begin{pmatrix} 0.637314 & -0.024231 & -0.770223 \\ 0.770207 & -0.012068 & 0.637680 \\ -0.024747 & -0.999634 & 0.010971 \\ -0.348361 & -0.001664 & -0.937359 \\ -0.937034 & 0.027018 & 0.348193 \\ 0.024747 & 0.999634 & -0.010971 \end{pmatrix}$
2	1.100430	-1.438480	0.306637	

# JS37: Elongated Triangular Pyramid



## Model Parameters

Model file:	Elongated_Triangular_Pyramid.ply
Sphericity:	0.28867
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.09737
Oriented-bounding-box lower bound to the MPF:	0.35016

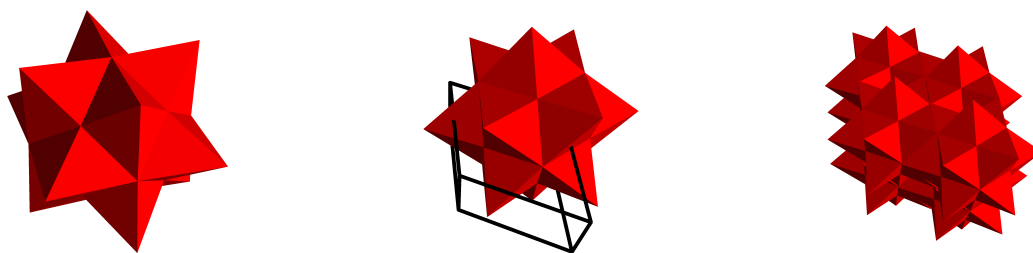
## Unit Cell Parameters

Number of particles:	4
Maximum packing fraction (MPF):	0.86089
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.992190, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.863785, -1.904700, 0.000000\}$ $\mathbf{v3} = \{0.067932, -0.278386, -1.224480\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.802877	-0.437405	-0.136794	$\begin{pmatrix} 0.592785 & -0.771326 & 0.231651 \\ -0.292887 & 0.061472 & 0.954169 \\ -0.750215 & -0.633465 & -0.189472 \end{pmatrix}$
2	1.260510	-1.709730	-0.991345	$\begin{pmatrix} -0.550040 & 0.438899 & 0.710509 \\ 0.366924 & -0.637252 & 0.677700 \\ 0.750215 & 0.633465 & 0.189472 \end{pmatrix}$
3	-0.681083	-1.965560	-0.336369	$\begin{pmatrix} 0.550040 & -0.438899 & -0.710509 \\ -0.366924 & 0.637252 & -0.677700 \\ 0.750215 & 0.633465 & 0.189472 \end{pmatrix}$
4	0.921409	-0.971622	-0.706295	$\begin{pmatrix} 0.550040 & -0.438899 & -0.710509 \\ 0.366924 & -0.637252 & 0.677700 \\ -0.750215 & -0.633465 & -0.189472 \end{pmatrix}$

# PH03: Escher's Solid



## Model Parameters

Model file: Eschers.Solid.ply  
 Sphericity: 0.55284  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.22922  
 Oriented-bounding-box lower bound to the MPF: 0.45845

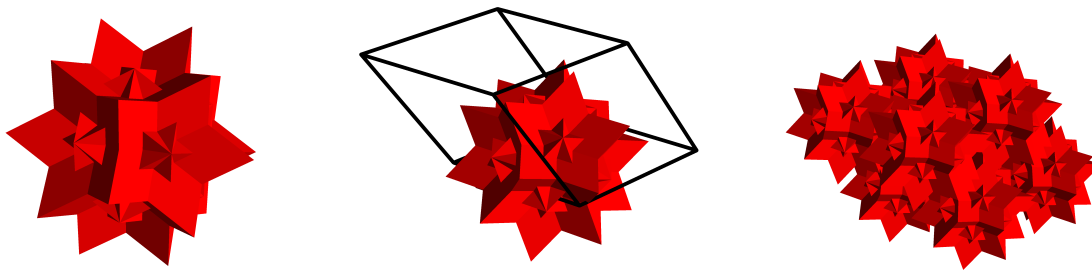
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 1.00000  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.101030, -0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-0.736771, 1.052880, -0.000000\}$   
 $\mathbf{v3} = \{0.368141, -0.525195, 0.910521\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.454468	0.502911	0.809013	$\begin{pmatrix} 0.002790 & -0.853773 & -0.520638 \\ -0.816787 & 0.298430 & -0.493760 \\ 0.576933 & 0.426628 & -0.696518 \end{pmatrix}$

# PH04: Great Rhombictriacontahedron



## Model Parameters

Model file: Great\_Rhombic\_Triacontahedron.ply  
Sphericity: 0.51160  
Centrosymmetric (C/NC): C  
Upper bound to the maximum packing fraction (MPF): 1.00000  
Outscribed-sphere lower bound to the MPF: 0.21644  
Oriented-bounding-box lower bound to the MPF: 0.20989

## Unit Cell Parameters

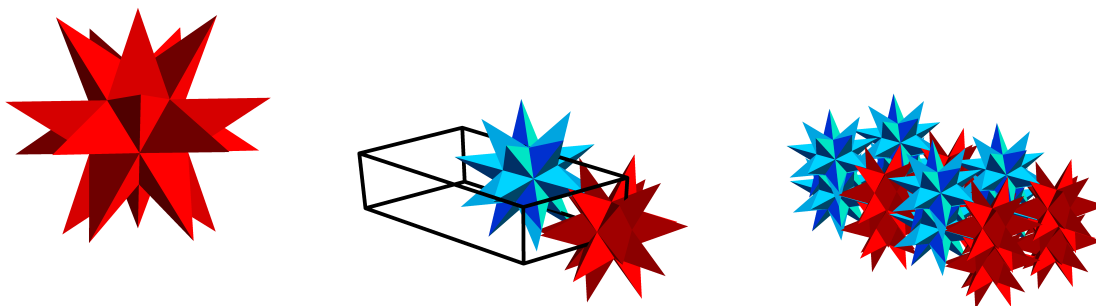
Number of particles: 1  
Maximum packing fraction (MPF): 0.55728  
Particles form a centrosymmetric compound (y/n/-): y  
Lattice Vectors:  
 $\mathbf{v1} = \{1.268850, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-0.593031, -1.219420, 0.000000\}$   
 $\mathbf{v3} = \{0.593031, 0.376822, -1.159740\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.729071	-0.403525	-1.146330	$\begin{pmatrix} -0.276393 & -0.296979 & 0.914008 \\ -0.850651 & -0.366966 & -0.376469 \\ 0.447214 & -0.881555 & -0.151198 \end{pmatrix}$



# PH05: Great Stellated Dodecahedron



## Model Parameters

Model file: Great\_Stellated\_Dodecahedron.ply  
 Sphericity: 0.18759  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.18806  
 Oriented-bounding-box lower bound to the MPF: 0.18237

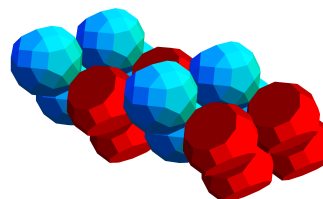
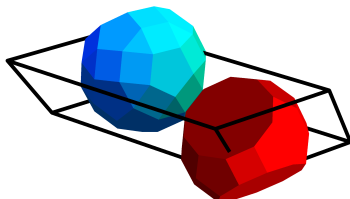
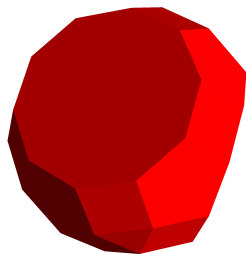
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.88967  
 Particles form a centrosymmetric compound (y/n/-): n  
 Lattice Vectors:  $\mathbf{v1} = \{2.346500, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.823346, 1.118370, -0.000000\}$   
 $\mathbf{v3} = \{0.000551, 0.003428, 0.856627\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.835090	1.072080	0.479003	$\begin{pmatrix} -0.035247 & 0.808356 & 0.587638 \\ -0.999343 & -0.033487 & -0.013877 \\ 0.008460 & -0.587741 & 0.809005 \\ -0.627904 & 0.621047 & 0.469082 \\ -0.472286 & 0.175008 & -0.863897 \\ -0.618613 & -0.763985 & 0.183424 \end{pmatrix}$
2	3.008070	1.070370	0.050689	

# JS38: Gyrate Bidiminished Rhombicosidodecahedron



## Model Parameters

Model file: Gyrate\_Bidiminished\_Rhombicosidodecahedron.ply  
 Sphericity: 0.77906  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.58695  
 Oriented-bounding-box lower bound to the MPF: 0.56431

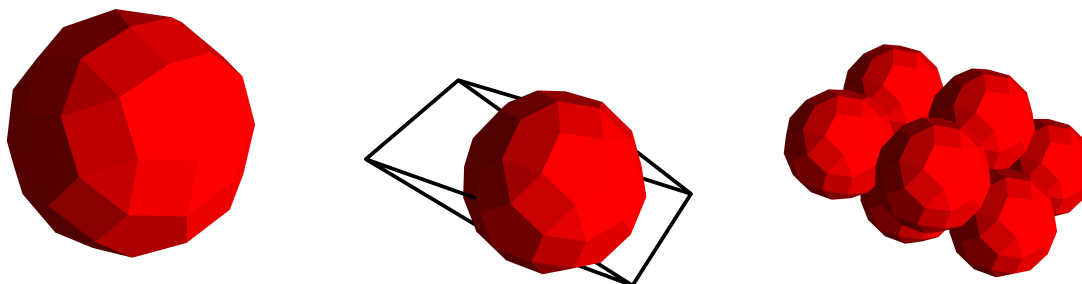
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.83325  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{2.353720, -0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-0.693843, -1.068650, 0.000000\}$   
 $\mathbf{v3} = \{-0.113285, -0.510968, 0.954247\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.354327	-0.856363	0.784365	$\begin{pmatrix} 0.017749 & 0.756328 & -0.653951 \\ -0.217966 & -0.635397 & -0.740785 \\ -0.975795 & 0.155687 & 0.153576 \end{pmatrix}$
2	1.486040	-0.791452	0.253474	$\begin{pmatrix} 0.549823 & -0.782129 & -0.293207 \\ 0.770990 & 0.610258 & -0.182097 \\ 0.321355 & -0.125938 & 0.938547 \end{pmatrix}$

# JS39: Gyrate Rhombicosidodecahedron



## Model Parameters

Model file:	Gyrate_Rhombicosidodecahedron.ply
Sphericity:	0.92459
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.83596
Outscribed-sphere lower bound to the MPF:	0.66075
Oriented-bounding-box lower bound to the MPF:	0.54302

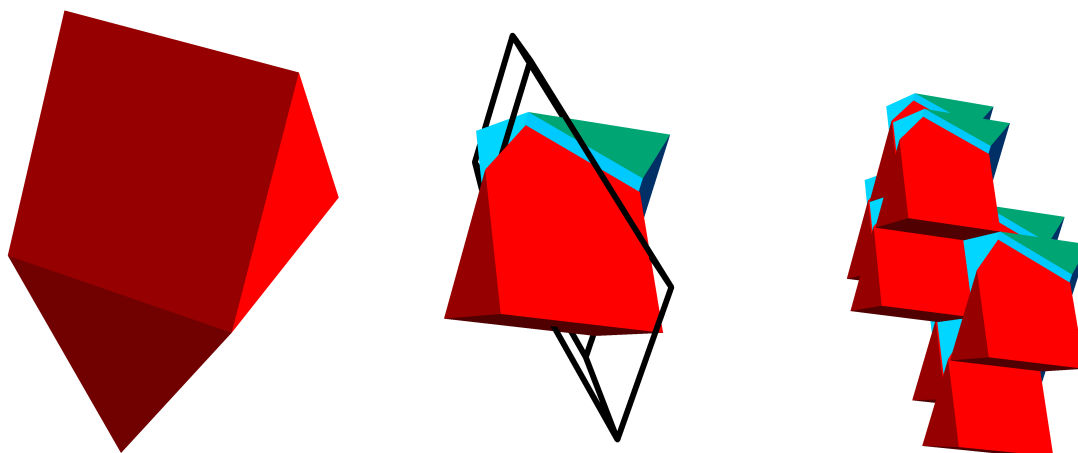
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.80470
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.222400, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.000001, 1.191740, -0.000000\}$ $\mathbf{v3} = \{-0.611197, -0.564830, 0.853039\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.595360	-0.033763	0.741369	$\begin{pmatrix} -0.156567 & 0.985225 & -0.069408 \\ 0.986466 & 0.159455 & 0.038196 \\ 0.048699 & -0.062488 & -0.996857 \end{pmatrix}$

# JS40: Gyrobifastigium



## Model Parameters

Model file: Gyrobifastigium.ply  
 Sphericity: 0.43301  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.15309  
 Oriented-bounding-box lower bound to the MPF: 0.50000

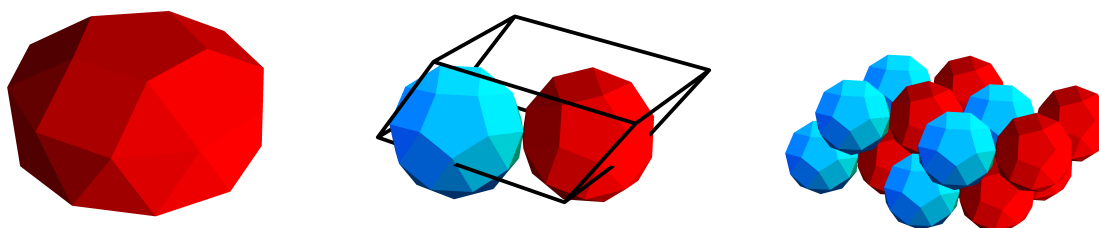
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 1.00000  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.049740, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.564738, 1.890330, -0.000000\}$   
 $\mathbf{v3} = \{0.478342, -1.605950, 1.009970\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.083490	0.403048	0.177515	$\begin{pmatrix} 0.999409 & 0.034368 & 0.000159 \\ -0.010020 & 0.286934 & 0.957898 \\ 0.032876 & -0.957334 & 0.287109 \end{pmatrix}$
2	1.016930	-0.329208	0.938501	$\begin{pmatrix} 0.999409 & 0.034368 & 0.000159 \\ 0.010020 & -0.286934 & -0.957898 \\ -0.032876 & 0.957334 & -0.287109 \end{pmatrix}$

# JS41: Gyroelongated Pentagonal Bicapola



## Model Parameters

Model file:	Gyroelongated_Pentagonal_Bicapola.ply
Sphericity:	0.57146
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.42911
Oriented-bounding-box lower bound to the MPF:	0.58293

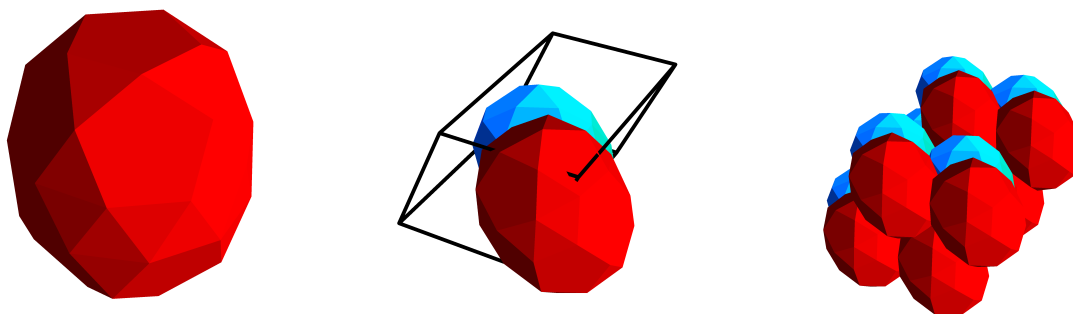
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.76412
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.274260, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.281099, -1.204180, 0.000000\}$ $\mathbf{v3} = \{0.568116, 0.334312, 0.955735\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.429542	-0.713626	0.010239	$\begin{pmatrix} -0.755189 & -0.634431 & -0.164886 \\ -0.569149 & 0.509823 & 0.645097 \\ -0.325206 & 0.581015 & -0.746098 \end{pmatrix}$
2	1.719550	-0.114129	0.015515	$\begin{pmatrix} -0.561531 & -0.743840 & -0.362471 \\ -0.764857 & 0.299458 & 0.570367 \\ -0.315717 & 0.597518 & -0.737086 \end{pmatrix}$

# JS42: Gyroelongated Pentagonal Birotunda



## Model Parameters

Model file: Gyroelongated\_Pentagonal\_Birotunda.ply  
 Sphericity: 0.78549  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 0.94171  
 Outscribed-sphere lower bound to the MPF: 0.45641  
 Oriented-bounding-box lower bound to the MPF: 0.55737

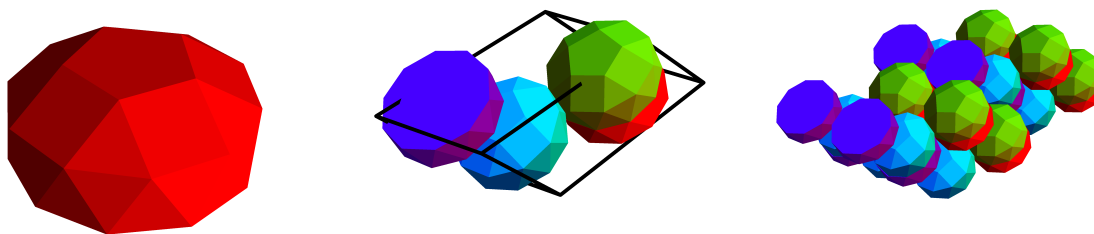
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.77761  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.219480, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-0.003204, -1.890800, 0.000000\}$   
 $\mathbf{v3} = \{0.512987, -0.004841, 1.116210\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.852047	-0.761222	0.253442	$\begin{pmatrix} -0.542868 & -0.736675 & -0.403242 \\ 0.638392 & -0.673959 & 0.371800 \\ -0.545664 & -0.055588 & 0.836158 \end{pmatrix}$
2	1.434010	-1.709190	0.603201	$\begin{pmatrix} 0.629261 & 0.689547 & 0.358545 \\ -0.572342 & 0.723245 & -0.386447 \\ -0.525789 & 0.037965 & 0.849767 \end{pmatrix}$

# JS43: Gyroelongated Pentagonal Cupola



## Model Parameters

Model file: Gyroelongated\_Pentagonal\_Cupola.ply  
 Sphericity: 0.41448  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.34161  
 Oriented-bounding-box lower bound to the MPF: 0.63982

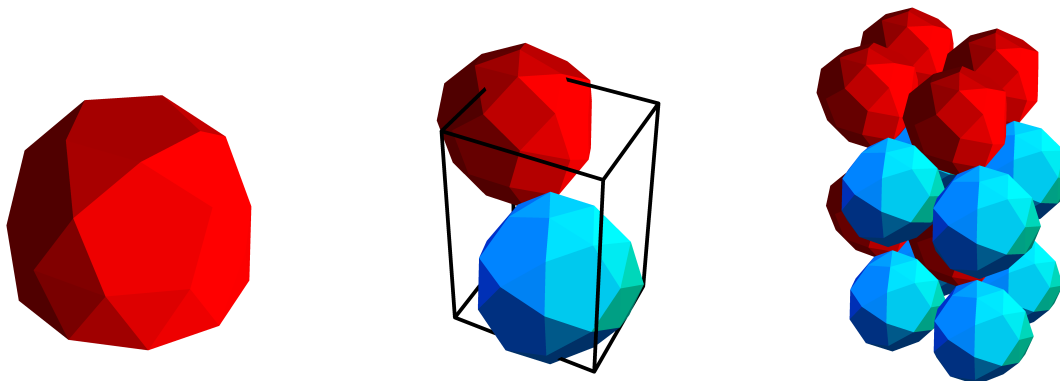
## Unit Cell Parameters

Number of particles: 4  
 Maximum packing fraction (MPF): 0.80695  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.555430, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-0.706092, -3.201750, 0.000000\}$   
 $\mathbf{v3} = \{0.677827, 0.783209, -0.995344\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.313010	-0.826269	-0.087363	$\begin{pmatrix} -0.389257 & -0.798925 & -0.458473 \\ 0.906635 & -0.420252 & -0.037438 \\ -0.162764 & -0.430240 & 0.887919 \\ 0.504683 & -0.809588 & -0.299771 \\ 0.847822 & 0.399326 & 0.348907 \\ -0.162764 & -0.430240 & 0.887919 \\ -0.962283 & -0.129605 & -0.239196 \\ -0.217991 & 0.893362 & 0.392918 \\ 0.162764 & 0.430240 & -0.887919 \\ 0.217990 & -0.893362 & -0.392918 \\ -0.962283 & -0.129605 & -0.239196 \\ 0.162764 & 0.430241 & -0.887919 \end{pmatrix}$
2	0.524804	-2.029410	-0.581396	
3	-0.085560	-2.579510	-0.102017	
4	1.387760	-0.580901	-0.596050	

# JS44: Gyroelongated Pentagonal Cupolarotunda



## Model Parameters

Model file:	Gyroelongated_Pentagonal_Cupolarotunda.ply
Sphericity:	0.78342
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.51719
Oriented-bounding-box lower bound to the MPF:	0.56621

## Unit Cell Parameters

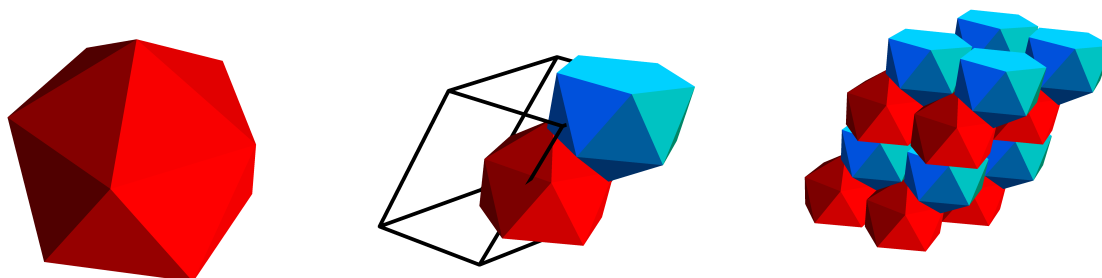
Number of particles:	2
Maximum packing fraction (MPF):	0.78540
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.278760, -0.000000, -0.000000\}$ $\mathbf{v2} = \{0.062039, -1.102760, 0.000000\}$ $\mathbf{v3} = \{-0.010244, 0.011443, 1.805790\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.799370	-0.745155	0.436024	$\begin{pmatrix} -0.549500 & 0.033623 & -0.834817 \\ 0.833477 & -0.047324 & -0.550524 \\ -0.058017 & -0.998314 & -0.002020 \end{pmatrix}$
2	0.111426	-0.036051	1.326330	$\begin{pmatrix} -0.549500 & 0.033623 & -0.834817 \\ -0.833477 & 0.047324 & 0.550524 \\ 0.058017 & 0.998314 & 0.002019 \end{pmatrix}$



# JS45: Gyroelongated Pentagonal Pyramid



## Model Parameters

Model file:	Gyroelongated_Pentagonal_Pyramid.ply
Sphericity:	0.64079
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.38637
Oriented-bounding-box lower bound to the MPF:	0.50959

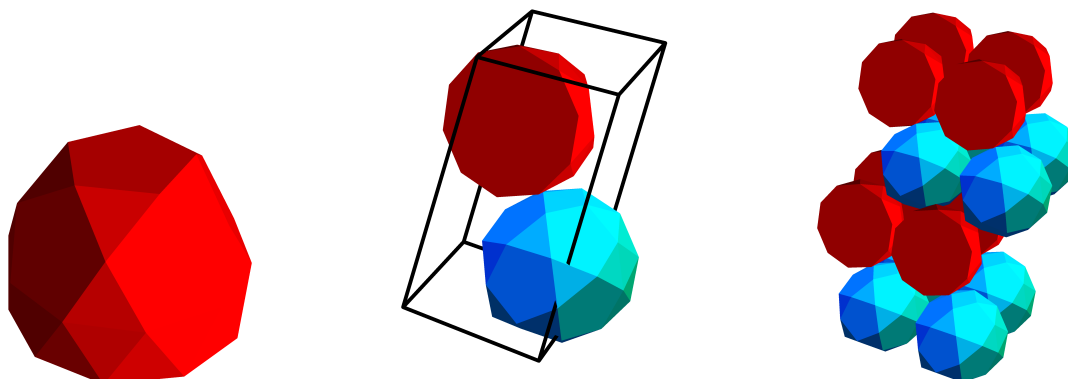
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.86077
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.258050, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.643251, 1.068490, -0.000000\}$ $\mathbf{v3} = \{0.712369, 0.431990, 1.728530\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	2.279750	1.009930	1.604330	$\begin{pmatrix} -0.131648 & -0.943428 & 0.304322 \\ -0.990284 & 0.111290 & -0.083382 \\ 0.044797 & -0.312342 & -0.948913 \end{pmatrix}$
2	1.631210	0.749722	0.701041	$\begin{pmatrix} 0.982497 & 0.185692 & -0.014740 \\ -0.180810 & 0.931644 & -0.315194 \\ -0.044797 & 0.312342 & 0.948913 \end{pmatrix}$

# JS46: Gyroelongated Pentagonal Rotunda



## Model Parameters

Model file:	Gyroelongated_Pentagonal_Rotunda.ply
Sphericity:	0.63546
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.44203
Oriented-bounding-box lower bound to the MPF:	0.59756

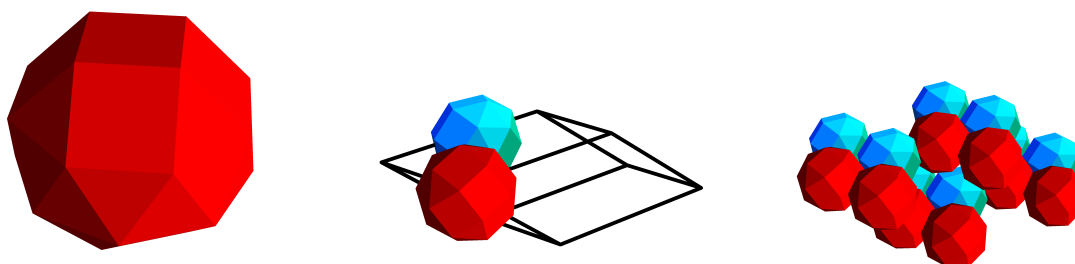
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.81250
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.346960, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.013820, 1.018900, 0.000000\}$ $\mathbf{v3} = \{0.011706, -1.384610, -1.793560\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.040040	-0.567663	-1.553610	$\begin{pmatrix} 0.615257 & -0.310778 & -0.724483 \\ 0.788326 & 0.242550 & 0.565430 \\ 0.000000 & -0.919014 & 0.394225 \end{pmatrix}$
2	0.359149	0.257661	-0.664672	$\begin{pmatrix} 0.961120 & -0.108857 & -0.253768 \\ -0.276130 & -0.378898 & -0.883283 \\ -0.000000 & 0.919014 & -0.394225 \end{pmatrix}$

# JS47: Gyroelongated Square Bicapola



## Model Parameters

Model file:	Gyroelongated_Square_Bicapola.ply
Sphericity:	0.82676
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.97994
Outscribed-sphere lower bound to the MPF:	0.55378
Oriented-bounding-box lower bound to the MPF:	0.54574

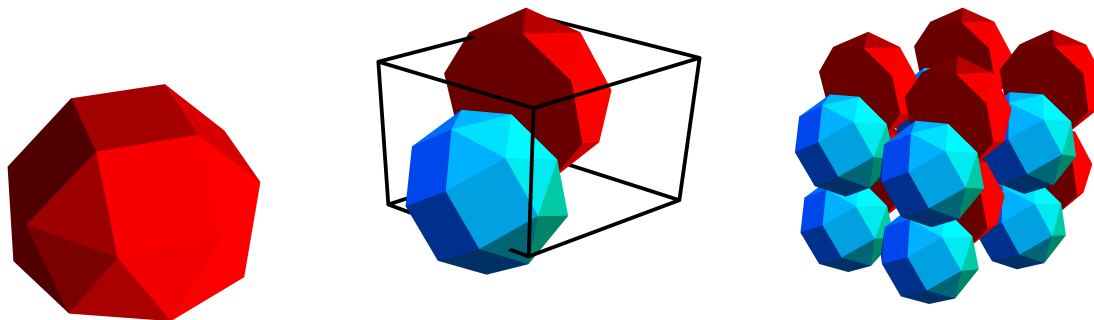
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.77850
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.206270, 0.000000, -0.000000\}$ $\mathbf{v2} = \{1.253030, 2.139960, -0.000000\}$ $\mathbf{v3} = \{-1.206270, -0.679944, 0.996358\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.433505	0.496998	0.894143	$\begin{pmatrix} -0.456256 & 0.888521 & -0.048595 \\ -0.488969 & -0.295963 & -0.820558 \\ -0.743465 & -0.350623 & 0.569494 \\ 0.626349 & 0.698978 & -0.345132 \\ 0.234405 & -0.591123 & -0.771769 \\ -0.743465 & 0.402496 & -0.534093 \end{pmatrix}$
2	0.105636	-0.579518	0.889683	

# JS48: Gyroelongated Square Cupola



## Model Parameters

Model file: Gyroelongated\_Square\_Cupola.ply  
 Sphericity: 0.56972  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.42183  
 Oriented-bounding-box lower bound to the MPF: 0.60324

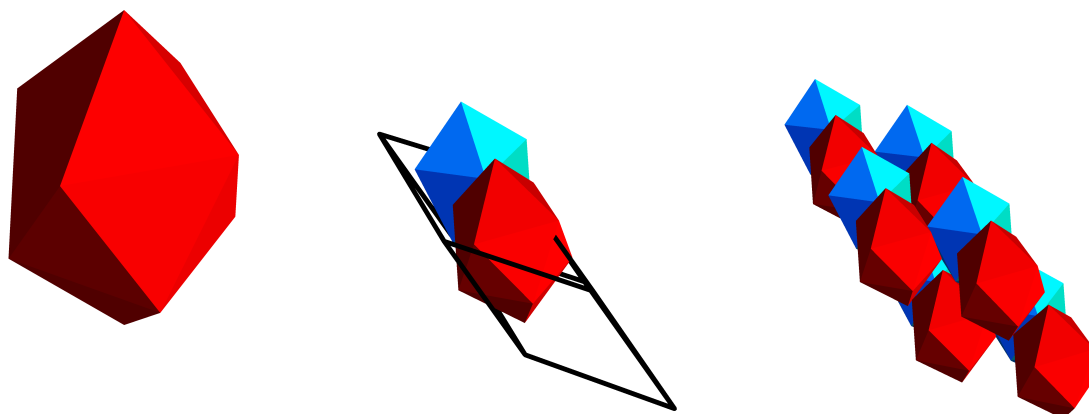
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.80712  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.401230, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.815185, 1.268980, -0.000000\}$   
 $\mathbf{v3} = \{-0.000000, 0.092302, 1.393570\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.725671	0.317443	0.123143	$\begin{pmatrix} 0.137561 & 0.054309 & 0.989003 \\ -0.987180 & 0.089116 & 0.132413 \\ -0.080945 & -0.994539 & 0.065872 \end{pmatrix}$
2	0.873722	1.064000	0.846496	$\begin{pmatrix} 0.987180 & -0.089116 & -0.132414 \\ -0.137561 & -0.054309 & -0.989003 \\ 0.080945 & 0.994539 & -0.065872 \end{pmatrix}$

# JS49: Gyroelongated Square Dipyramid



## Model Parameters

Model file: Gyroelongated\_Square\_Dipyramid.ply  
 Sphericity: 0.51974  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.17614  
 Oriented-bounding-box lower bound to the MPF: 0.43129

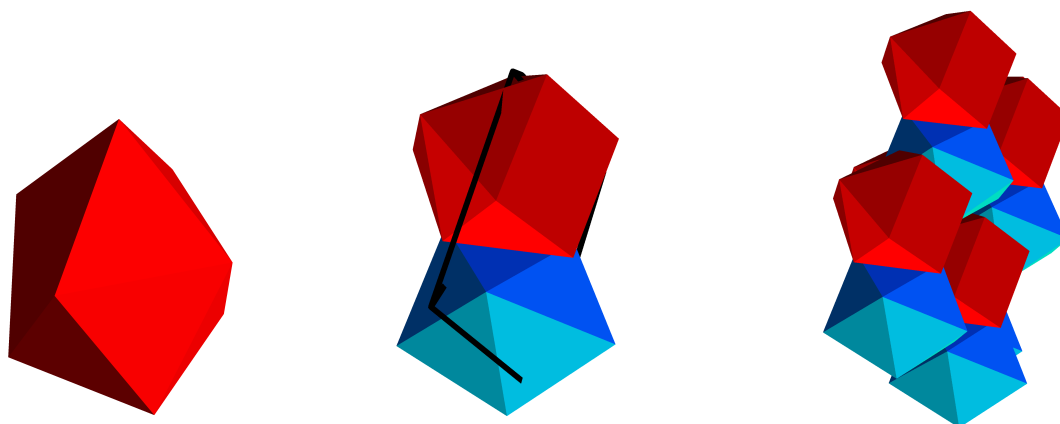
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.80261  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.658920, -0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-1.661480, 1.354830, -0.000000\}$   
 $\mathbf{v3} = \{0.922762, -0.007414, -1.108710\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.391583	1.310180	-0.232876	$\begin{pmatrix} -0.984367 & -0.008912 & -0.175905 \\ -0.005759 & 0.999814 & -0.018432 \\ 0.176037 & -0.017131 & -0.984235 \\ 0.700124 & -0.700673 & 0.137417 \\ -0.691980 & -0.713277 & -0.111350 \\ 0.176037 & -0.017131 & -0.984235 \end{pmatrix}$
2	0.400197	0.635352	-0.304121	

# JS50: Gyroelongated Square Pyramid



## Model Parameters

Model file:	Gyroelongated_Square_Pyramid.ply
Sphericity:	0.59228
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.25752
Oriented-bounding-box lower bound to the MPF:	0.45133

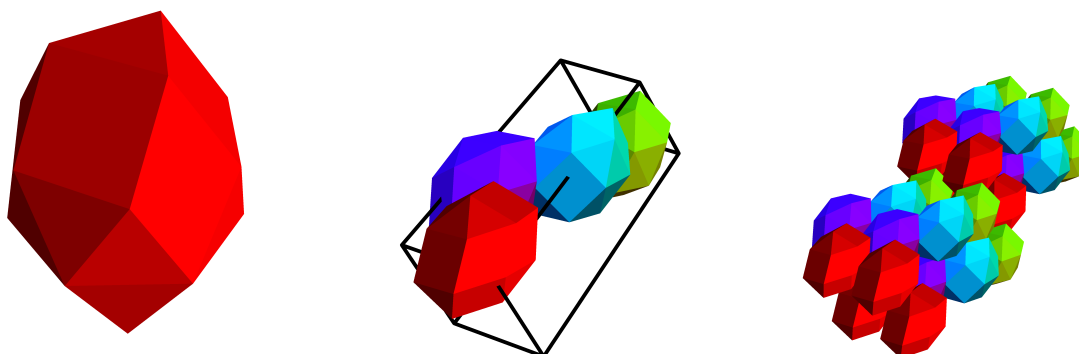
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.82236
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.782030, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.035149, 1.285590, -0.000000\}$ $\mathbf{v3} = \{0.874663, -1.234200, 1.061570\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	2.206890	-0.051912	0.735014	$\begin{pmatrix} -0.986958 & -0.074653 & 0.142620 \\ 0.073323 & -0.997202 & -0.014565 \\ 0.143308 & -0.003918 & 0.989670 \end{pmatrix}$
2	1.259790	-0.698173	0.778559	$\begin{pmatrix} -0.073323 & 0.997202 & 0.014565 \\ 0.986958 & 0.074653 & -0.142620 \\ -0.143308 & 0.003918 & -0.989670 \end{pmatrix}$

# JS51: Gyroelongated Triangular Bicapola



## Model Parameters

Model file:	Gyroelongated_Triangular_Bicapola.ply
Sphericity:	0.67198
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.32153
Oriented-bounding-box lower bound to the MPF:	0.52112

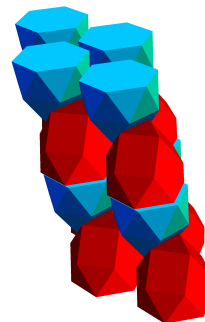
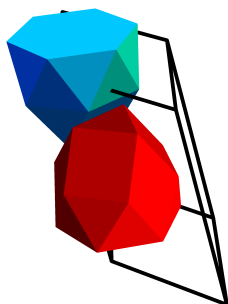
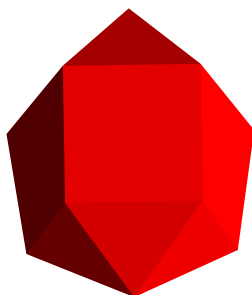
## Unit Cell Parameters

Number of particles:	4
Maximum packing fraction (MPF):	0.79162
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.158970, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.297900, -4.330290, 0.000000\}$ $\mathbf{v3} = \{0.563174, 0.118672, -1.006820\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.210940	-0.666052	-0.627694	$\begin{pmatrix} 0.699722 & -0.265376 & 0.663298 \\ -0.708108 & -0.134530 & 0.693170 \\ -0.094717 & -0.954713 & -0.282048 \end{pmatrix}$
2	1.180180	-1.786680	-0.195339	$\begin{pmatrix} -0.251923 & 0.297087 & -0.921018 \\ 0.963101 & -0.016182 & -0.268654 \\ -0.094717 & -0.954713 & -0.282048 \end{pmatrix}$
3	0.526863	-2.870900	-0.074353	$\begin{pmatrix} -0.708108 & -0.134530 & 0.693170 \\ 0.699722 & -0.265376 & 0.663298 \\ 0.094717 & 0.954713 & 0.282048 \end{pmatrix}$
4	1.060750	-3.966290	-0.024927	$\begin{pmatrix} 0.251923 & -0.297087 & 0.921018 \\ -0.963101 & 0.016182 & 0.268653 \\ -0.094717 & -0.954713 & -0.282048 \end{pmatrix}$

# JS52: Gyroelongated Triangular Cupola



## Model Parameters

Model file:	Gyroelongated_Triangular_Cupola.ply
Sphericity:	0.64231
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.37306
Oriented-bounding-box lower bound to the MPF:	0.56343

## Unit Cell Parameters

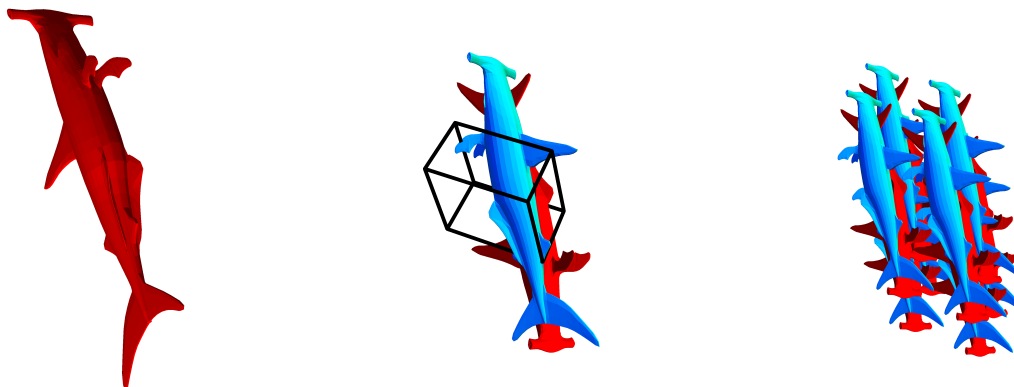
Number of particles:	2
Maximum packing fraction (MPF):	0.83145
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.283460, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.653085, 1.108180, -0.000000\}$ $\mathbf{v3} = \{-0.862638, 0.526032, 1.691220\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.806553	0.751413	1.602980	$\begin{pmatrix} 0.757431 & 0.652130 & 0.032011 \\ 0.642436 & -0.753128 & 0.141682 \\ 0.116503 & -0.086749 & -0.989395 \end{pmatrix}$
2	-0.132626	0.343827	0.774889	$\begin{pmatrix} -0.177651 & 0.978293 & -0.106694 \\ -0.977173 & -0.188197 & -0.098564 \\ -0.116504 & 0.086749 & 0.989395 \end{pmatrix}$



# MS07: Hammerhead Shark



## Model Parameters

Model file:	Hammerhead_Shark.ply
Sphericity:	0.11355
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.00853
Oriented-bounding-box lower bound to the MPF:	0.06853

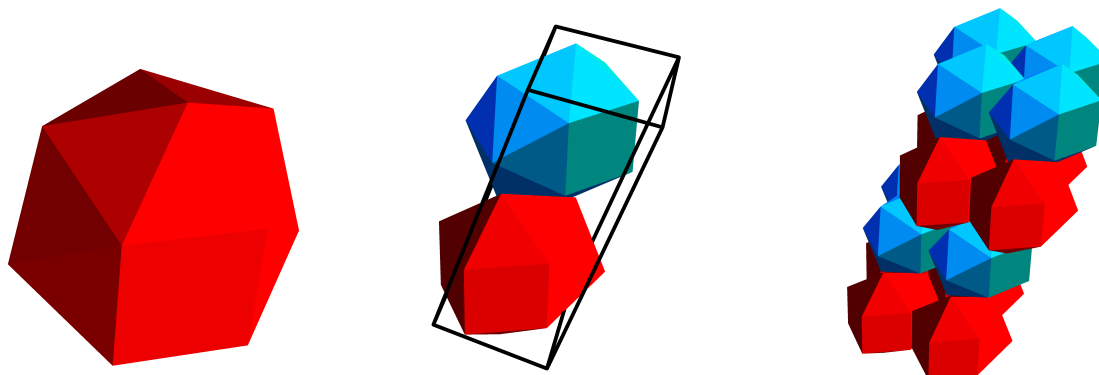
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.47242
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.874790, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.317782, 1.437090, 0.000000\}$ $\mathbf{v3} = \{0.009336, 0.520699, -1.571300\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.272010	1.161790	-0.908000	$\begin{pmatrix} 0.537230 & -0.578414 & -0.613858 \\ 0.819712 & 0.186656 & 0.541509 \\ -0.198636 & -0.794101 & 0.574410 \\ -0.537807 & 0.578649 & 0.613130 \\ -0.819549 & -0.188250 & -0.541204 \\ -0.197746 & -0.793554 & 0.575473 \end{pmatrix}$
2	0.758733	1.623920	-1.511650	

# JS53: Hebesphenomegacorona



## Model Parameters

Model file:	Hebesphenomegacorona.ply
Sphericity:	0.62123
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.36444
Oriented-bounding-box lower bound to the MPF:	0.54634

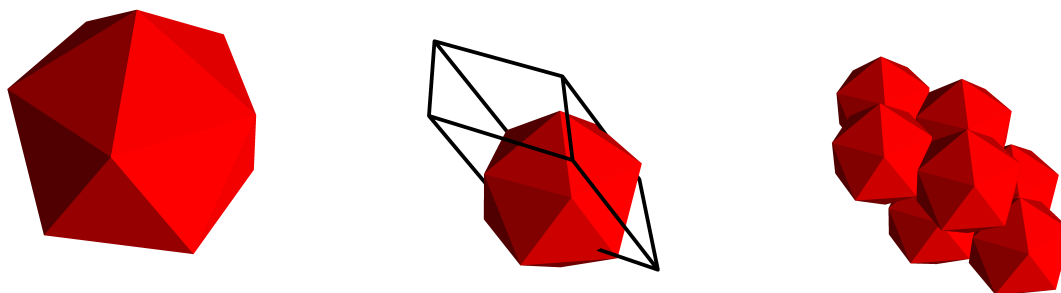
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.83853
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.101020, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.312097, -0.998116, 0.000000\}$ $\mathbf{v3} = \{-0.637309, -0.580059, -2.170370\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.108388	-0.228132	-0.823221	$\begin{pmatrix} 0.641792 & -0.343257 & 0.685768 \\ -0.637220 & 0.258838 & 0.725916 \\ -0.426678 & -0.902872 & -0.052610 \\ -0.604210 & 0.391987 & 0.693741 \\ 0.676247 & -0.208234 & 0.706632 \\ 0.421451 & 0.896094 & -0.139263 \end{pmatrix}$
2	0.062288	-0.813970	-1.900550	

# PS02: Icosahedron



## Model Parameters

Model file: Icosahedron.ply  
 Sphericity: 0.79465  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 0.89343  
 Outscribed-sphere lower bound to the MPF: 0.44833  
 Oriented-bounding-box lower bound to the MPF: 0.51502

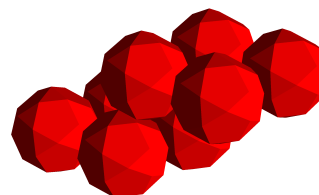
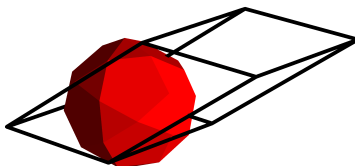
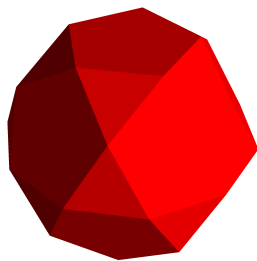
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.83635  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.224440, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-0.601661, 1.004290, 0.000000\}$   
 $\mathbf{v3} = \{0.622762, 0.256502, -0.972341\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.830911	0.588250	-0.815466	$\begin{pmatrix} 0.645390 & 0.277772 & -0.711557 \\ -0.763776 & 0.221471 & -0.606297 \\ -0.010823 & 0.934769 & 0.355091 \end{pmatrix}$

# AS08: Icosidodecahedron



## Model Parameters

Model file:	Icosidodecahedron.ply
Sphericity:	0.85064
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.93800
Outscribed-sphere lower bound to the MPF:	0.57737
Oriented-bounding-box lower bound to the MPF:	0.50464

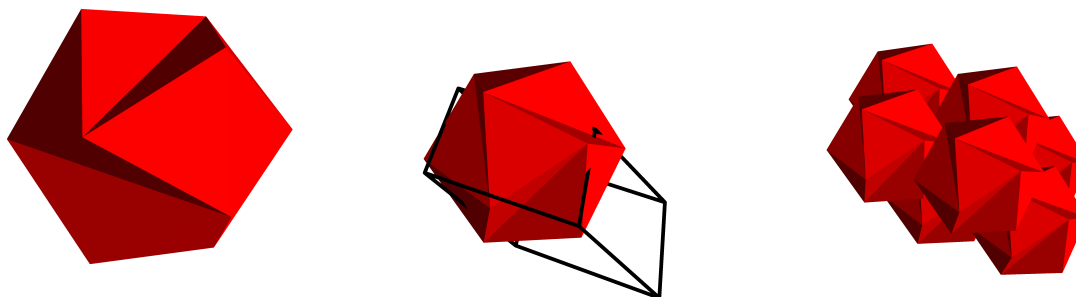
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.86472
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.179780, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.583439, -1.018400, -0.000000\}$ $\mathbf{v3} = \{1.179850, 0.676550, 0.962840\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.333989	-0.163041	0.059610	$\begin{pmatrix} -0.188373 & 0.928825 & 0.319061 \\ -0.140923 & -0.347079 & 0.927188 \\ 0.971934 & 0.129694 & 0.196273 \end{pmatrix}$

# PH06: Jessen's Orthogonal Icosahedron



## Model Parameters

Model file:	Jessens_Orthogonal_Icosahedron.ply
Sphericity:	0.53633
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.34558
Oriented-bounding-box lower bound to the MPF:	0.39699

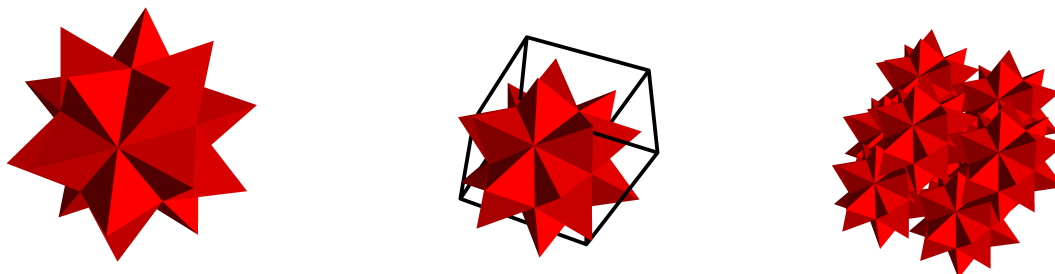
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.74965
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.271060, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.423686, -1.100830, -0.000000\}$ $\mathbf{v3} = \{0.423686, 0.550416, -0.953349\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.867916	-0.302769	-0.264417	$\begin{pmatrix} 0.577350 & 0.604153 & -0.549241 \\ 0.577350 & 0.173580 & 0.797833 \\ 0.577351 & -0.777733 & -0.248591 \end{pmatrix}$

# PH07: Mathematica Spikey 1



## Model Parameters

Model file: Mathematica\_Spikey\_1.ply  
 Sphericity: 0.51455  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.20643  
 Oriented-bounding-box lower bound to the MPF: 0.20019

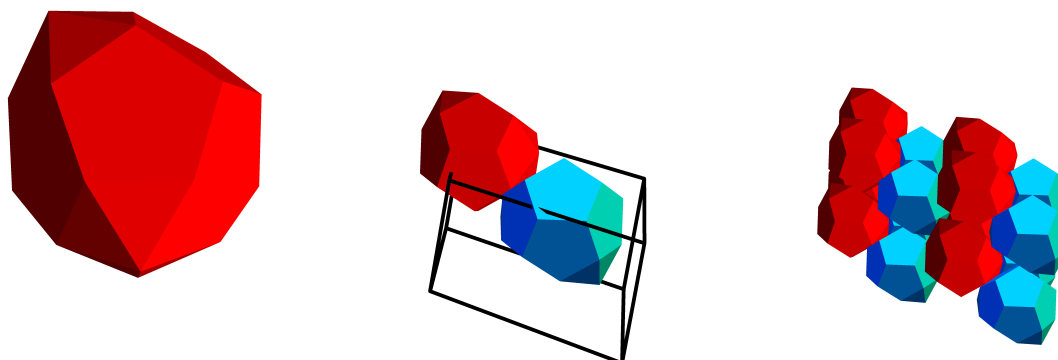
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.55602  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.414160, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.607870, -1.241680, 0.000000\}$   
 $\mathbf{v3} = \{-0.492586, -0.362821, -1.027250\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.977133	-1.354040	-0.363762	$\begin{pmatrix} 0.068293 & 0.918983 & -0.388338 \\ 0.918930 & -0.209504 & -0.334180 \\ -0.388464 & -0.334033 & -0.858789 \end{pmatrix}$

# JS54: Metabiaugmented Dodecahedron



## Model Parameters

Model file:	Metabiaugmented_Dodecahedron.ply
Sphericity:	0.71464
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.38632
Oriented-bounding-box lower bound to the MPF:	0.51502

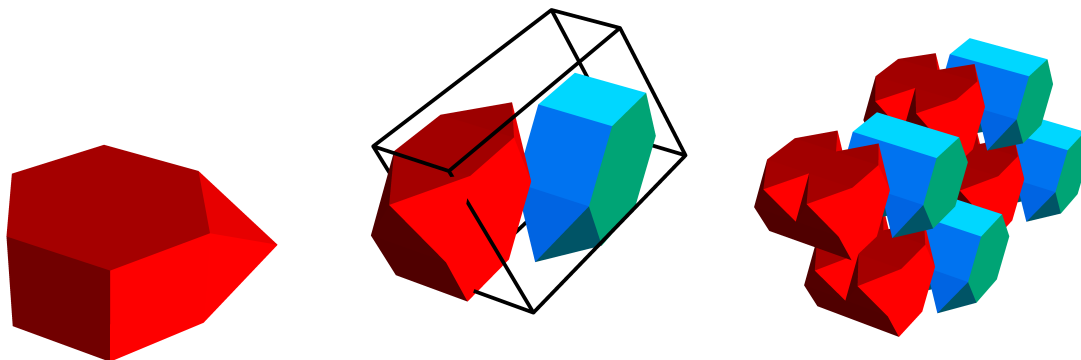
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.87796
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.246950, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.441837, 1.014060, 0.000000\}$ $\mathbf{v3} = \{-0.115801, 0.658250, 0.999770\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.996295	1.108210	0.560273	$\begin{pmatrix} 0.588125 & -0.797261 & 0.135954 \\ -0.302920 & -0.061281 & 0.951044 \\ -0.749899 & -0.600516 & -0.277548 \end{pmatrix}$
2	-0.183760	1.379880	0.927905	$\begin{pmatrix} 0.656455 & 0.620032 & -0.429684 \\ -0.661127 & 0.198562 & -0.723522 \\ -0.363287 & 0.759035 & 0.540267 \end{pmatrix}$

# JS55: Metabiaugmented Hexagonal Prism



## Model Parameters

Model file:	Metabiaugmented_Hexagonal_Prism.ply
Sphericity:	0.35100
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.18772
Oriented-bounding-box lower bound to the MPF:	0.65039

## Unit Cell Parameters

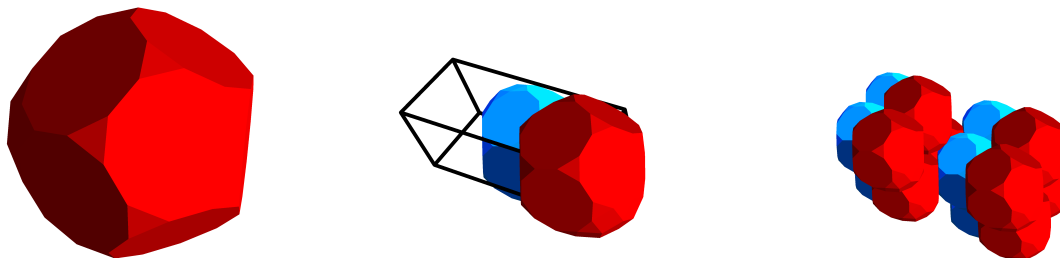
Number of particles:	2
Maximum packing fraction (MPF):	0.93602
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.688090, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.214437, 2.581280, -0.000000\}$ $\mathbf{v3} = \{0.687865, 0.080010, -1.203380\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.046740	1.700050	-0.881709	$\begin{pmatrix} -0.000001 & -0.996183 & 0.087284 \\ 0.000002 & -0.087284 & -0.996183 \\ 1.000000 & -0.000001 & 0.000002 \\ 0.000001 & 0.996183 & -0.087284 \\ -0.000002 & 0.087284 & 0.996183 \\ 1.000000 & -0.000001 & 0.000002 \end{pmatrix}$
2	0.488480	0.367909	-0.610164	



# JS56: Metabiaugmented Truncated Dodecahedron



## Model Parameters

Model file:	Metabiaugmented_Truncated_Dodecahedron.ply
Sphericity:	0.80327
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.53239
Oriented-bounding-box lower bound to the MPF:	0.52766

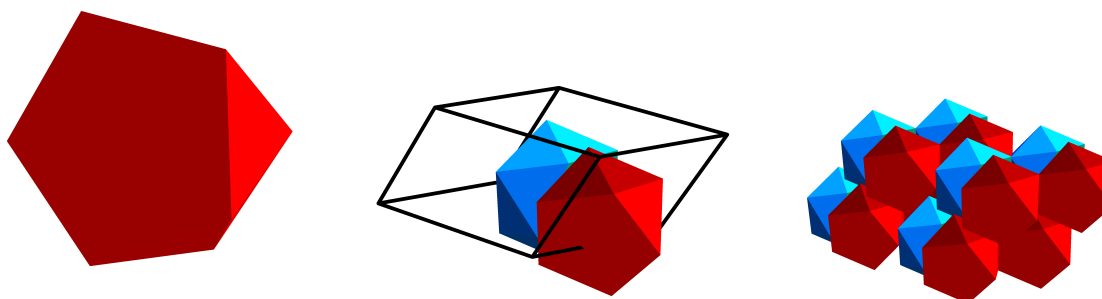
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.86978
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.034870, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.104440, 1.108100, -0.000000\}$ $\mathbf{v3} = \{0.040327, -0.532134, 1.019770\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.820915	0.749859	0.129555	$\begin{pmatrix} 0.788163 & -0.075810 & -0.610779 \\ -0.009848 & -0.993811 & 0.110644 \\ -0.615387 & -0.081190 & -0.784032 \end{pmatrix}$
2	1.939420	-0.355811	0.896154	$\begin{pmatrix} 0.553734 & -0.616188 & 0.560081 \\ 0.796471 & 0.588160 & -0.140363 \\ -0.242927 & 0.523812 & 0.816460 \end{pmatrix}$

# JS57: Metabidiminished Icosahedron



## Model Parameters

Model file: Metabidiminished\_Icosahedron.ply  
 Sphericity: 0.57232  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.32441  
 Oriented-bounding-box lower bound to the MPF: 0.46065

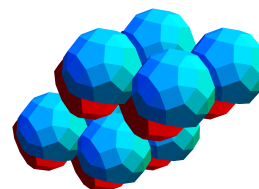
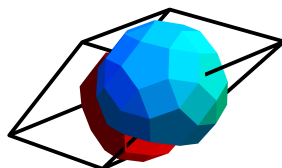
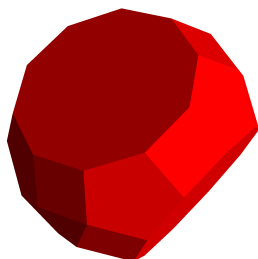
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.91942  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.956730, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.972096, 0.987523, -0.000000\}$   
 $\mathbf{v3} = \{0.502442, 0.499614, 1.125740\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.623630	0.998374	0.057990	$\begin{pmatrix} 0.004805 & 0.026733 & -0.999631 \\ -0.696030 & 0.717838 & 0.015852 \\ 0.717997 & 0.695697 & 0.022057 \end{pmatrix}$
2	2.437270	0.823878	0.097633	$\begin{pmatrix} 0.004805 & 0.026733 & -0.999631 \\ 0.696030 & -0.717838 & -0.015852 \\ -0.717997 & -0.695697 & -0.022057 \end{pmatrix}$

# JS58: Metabidiminished Rhombicosidodecahedron



## Model Parameters

Model file:	Metabidiminished_Rhombicosidodecahedron.ply
Sphericity:	0.77852
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.58695
Oriented-bounding-box lower bound to the MPF:	0.56431

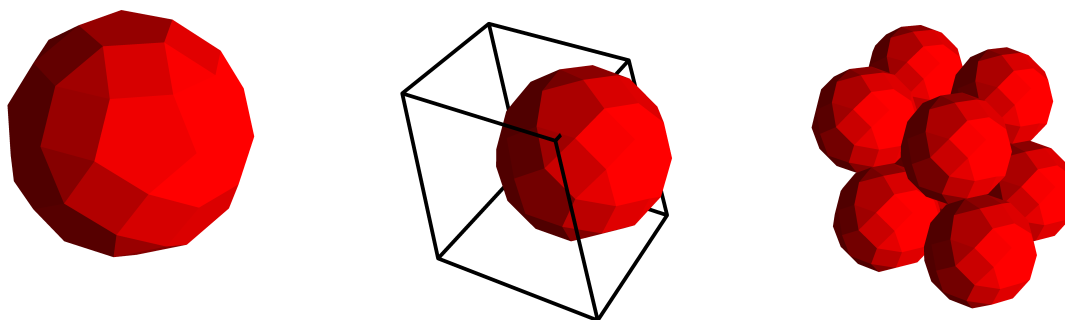
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.83373
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.273570, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.489791, -0.968559, -0.000000\}$ $\mathbf{v3} = \{1.284290, -0.372250, 1.944710\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.590780	-1.191110	1.609720	$\begin{pmatrix} 0.788554 & 0.599917 & -0.135210 \\ 0.485910 & -0.473062 & 0.734917 \\ 0.376927 & -0.645222 & -0.664541 \end{pmatrix}$
2	0.984572	-0.466584	0.651700	$\begin{pmatrix} -0.470348 & 0.331846 & 0.817711 \\ -0.390389 & 0.752763 & -0.530041 \\ -0.791435 & -0.568530 & -0.224511 \end{pmatrix}$

# JS59: Metabigyrate Rhombicosidodecahedron



## Model Parameters

Model file:	Metabigyrate_Rhombicosidodecahedron.ply
Sphericity:	0.92459
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.83596
Outscribed-sphere lower bound to the MPF:	0.66075
Oriented-bounding-box lower bound to the MPF:	0.54302

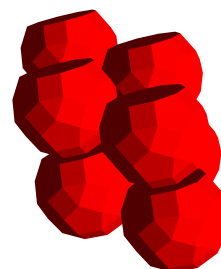
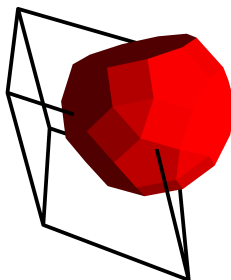
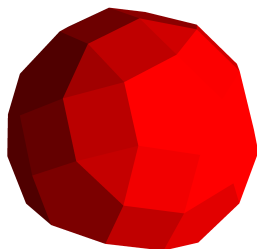
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.80470
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.222400, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.000003, 1.191740, -0.000000\}$ $\mathbf{v3} = \{0.611201, -0.564830, -0.853035\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.185310	0.510297	-0.442219	$\begin{pmatrix} -0.361087 & 0.048674 & 0.931261 \\ -0.342621 & -0.935716 & -0.083941 \\ 0.867310 & -0.349379 & 0.354552 \end{pmatrix}$

# JS60: Metagrate Diminished Rhombicosidodecahedron



## Model Parameters

Model file:	Metagrate_Diminished_Rhombicosidodecahedron.ply
Sphericity:	0.80687
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.62385
Oriented-bounding-box lower bound to the MPF:	0.58749

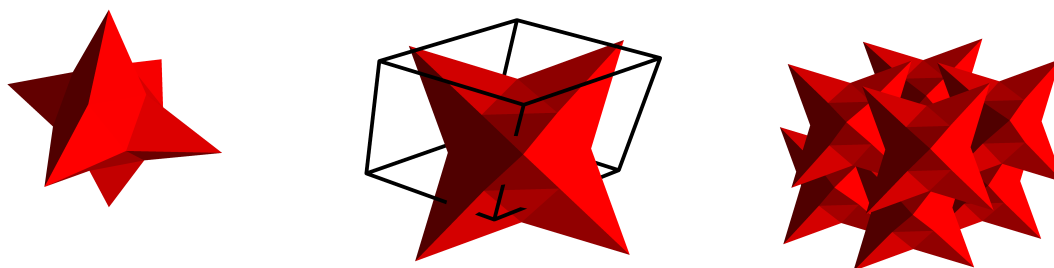
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.82056
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.217220, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.579486, -1.070470, 0.000000\}$ $\mathbf{v3} = \{-0.428538, 0.255374, 0.935286\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.087240	-0.321322	0.742143	$\begin{pmatrix} 0.608298 & -0.652851 & 0.451396 \\ -0.433618 & -0.749693 & -0.499935 \\ 0.664792 & 0.108376 & -0.739125 \end{pmatrix}$

# PA02: Nanostar



## Model Parameters

Model file: Nanostar.ply  
Sphericity: 0.38489  
Centrosymmetric (C/NC): C  
Upper bound to the maximum packing fraction (MPF): 1.00000  
Outscribed-sphere lower bound to the MPF: 0.09602  
Oriented-bounding-box lower bound to the MPF: 0.22903

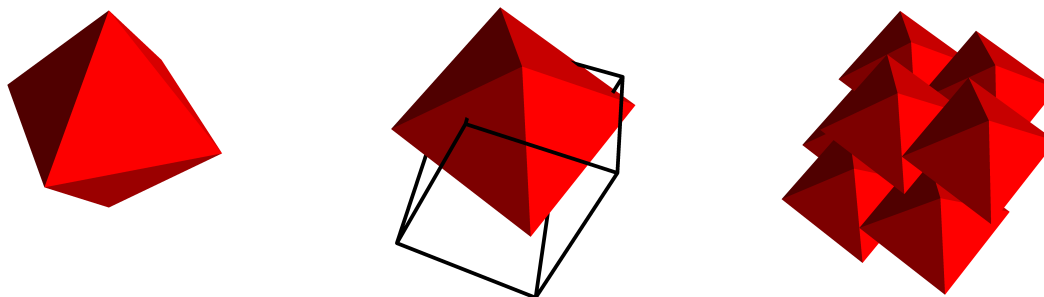
## Unit Cell Parameters

Number of particles: 1  
Maximum packing fraction (MPF): 0.68615  
Particles form a centrosymmetric compound (y/n/-): y  
Lattice Vectors:  
 $\mathbf{v1} = \{1.212690, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.604235, 1.033200, -0.000000\}$   
 $\mathbf{v3} = \{0.255349, -0.010075, 1.163170\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.131350	0.566325	0.266095	$\begin{pmatrix} -0.826214 & -0.000429 & 0.563356 \\ 0.398353 & 0.706662 & 0.584760 \\ -0.398353 & 0.707551 & -0.583683 \end{pmatrix}$

# AP03: Octahedron



## Model Parameters

Model file: Octahedron.ply  
 Sphericity: 0.57734  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.23570  
 Oriented-bounding-box lower bound to the MPF: 0.56218

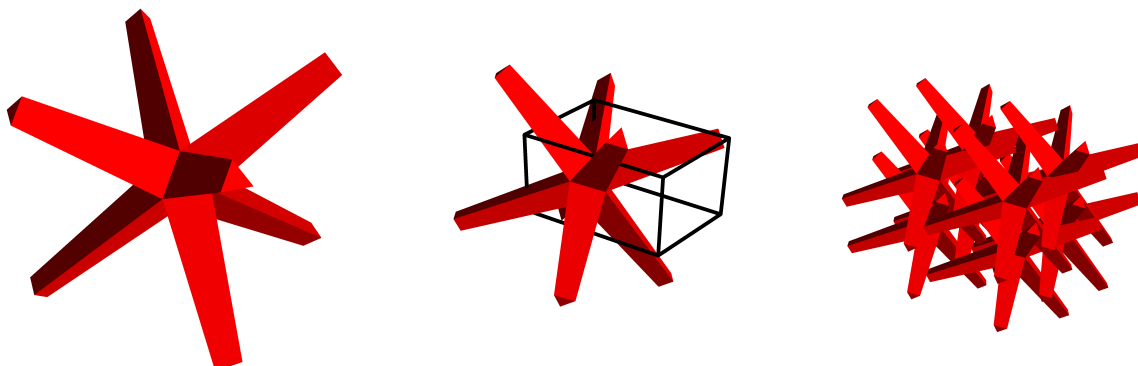
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.94736  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.122760, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.413770, -1.059670, 0.000000\}$   
 $\mathbf{v3} = \{0.340509, 0.444771, 0.888876\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.838486	-0.064440	0.635210	$\begin{pmatrix} 0.498819 & -0.662622 & -0.558669 \\ -0.809217 & -0.586916 & -0.026401 \\ -0.310398 & 0.465254 & -0.828970 \end{pmatrix}$

# PA03: Octapod



## Model Parameters

Model file:	Octapod.ply
Sphericity:	0.13281
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.02525
Oriented-bounding-box lower bound to the MPF:	0.06681

## Unit Cell Parameters

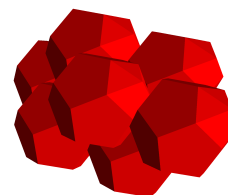
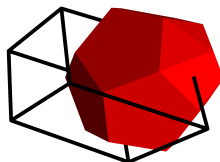
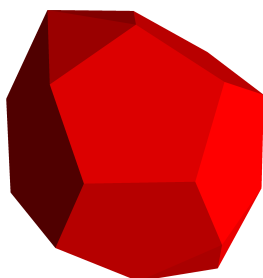
Number of particles:	1
Maximum packing fraction (MPF):	0.31077
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{2.034680, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.399538, -1.226780, 0.000000\}$ $\mathbf{v3} = \{0.005676, -0.000681, 1.289100\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.384033	-0.899160	0.592227	$\begin{pmatrix} -0.950988 & 0.309200 & 0.004210 \\ 0.132336 & 0.394638 & 0.909257 \\ 0.279481 & 0.865249 & -0.416214 \end{pmatrix}$



# JS61: Parabiaugmented Dodecahedron



## Model Parameters

Model file:	Parabiaugmented_Dodecahedron.ply
Sphericity:	0.67926
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.33173
Oriented-bounding-box lower bound to the MPF:	0.51502

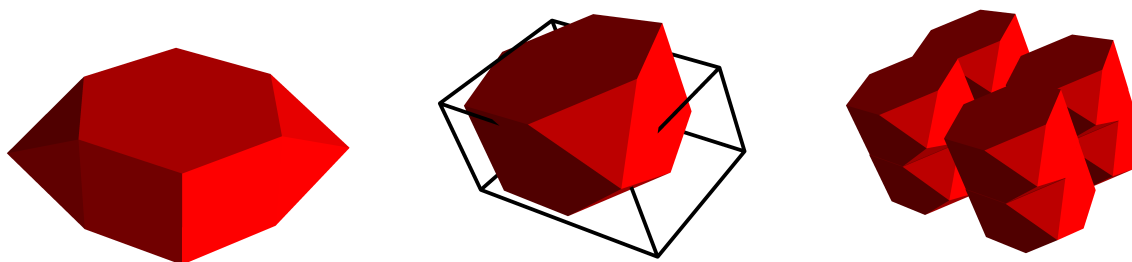
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.88941
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.211760, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.609511, -0.924248, 0.000000\}$ $\mathbf{v3} = \{0.862637, -0.399816, 1.003900\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.765840	-0.563091	0.662123	$\begin{pmatrix} -0.600177 & 0.774651 & -0.199257 \\ -0.607207 & -0.279096 & 0.743912 \\ 0.520660 & 0.567470 & 0.637880 \end{pmatrix}$

# JS62: Parabiaugmented Hexagonal Prism



## Model Parameters

Model file:	Parabiaugmented_Hexagonal_Prism.ply
Sphericity:	0.31783
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.13937
Oriented-bounding-box lower bound to the MPF:	0.65778

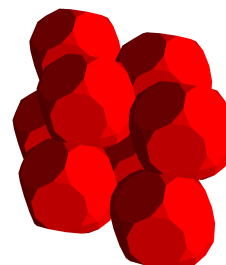
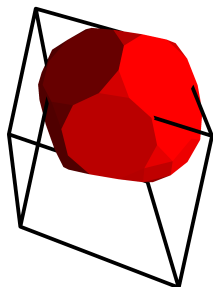
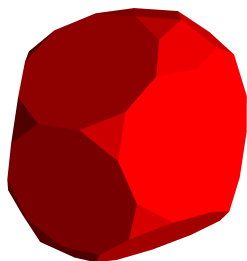
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.97102
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.301960, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.099255, 1.225360, -0.000000\}$ $\mathbf{v3} = \{-0.235505, -0.027550, 0.646027\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.472843	0.539280	0.488307	$\begin{pmatrix} 0.217045 & -0.975921 & 0.021668 \\ 0.915396 & 0.211193 & 0.342707 \\ -0.339031 & -0.054548 & 0.939192 \end{pmatrix}$

# JS63: Parabiaugmented Truncated Dodecahedron



## Model Parameters

Model file:	Parabiaugmented_Truncated_Dodecahedron.ply
Sphericity:	0.79465
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.51540
Oriented-bounding-box lower bound to the MPF:	0.52766

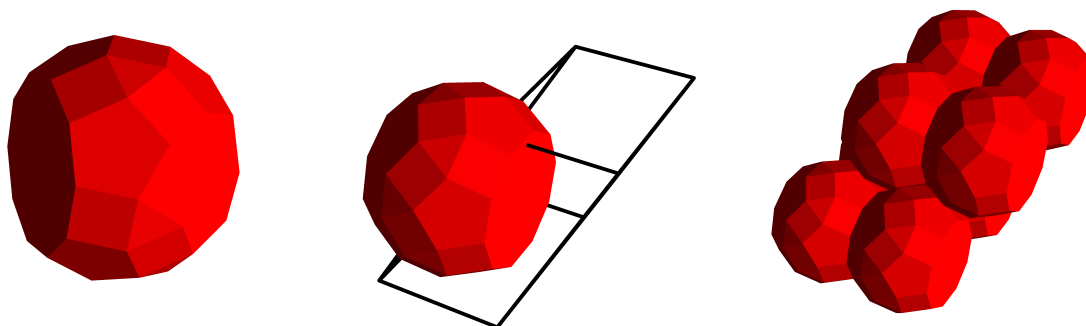
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.88053
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.341690, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.716617, -0.945485, 0.000000\}$ $\mathbf{v3} = \{0.088125, -0.657496, -0.895252\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.129630	-0.593901	-0.270169	$\begin{pmatrix} -0.668111 & -0.503742 & -0.547606 \\ -0.387441 & -0.392791 & 0.834029 \\ -0.635230 & 0.769389 & 0.067258 \end{pmatrix}$

# JS64: Parabidiminished Rhombicosidodecahedron



## Model Parameters

Model file:	Parabidiminished_Rhombicosidodecahedron.ply
Sphericity:	0.68915
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.58695
Oriented-bounding-box lower bound to the MPF:	0.63661

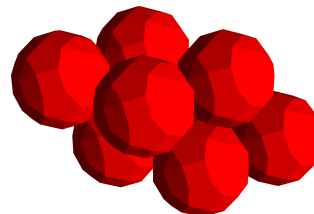
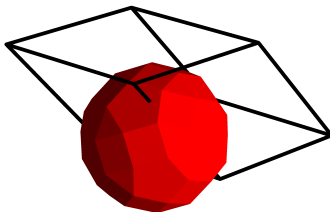
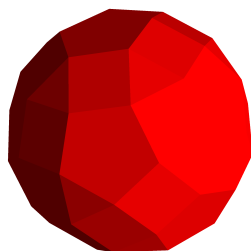
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.85486
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{0.923901, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.000130, 1.271620, -0.000000\}$ $\mathbf{v3} = \{0.512636, 0.635541, 0.995687\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.334298	0.569964	0.595176	$\begin{pmatrix} -0.604020 & -0.726819 & -0.326946 \\ -0.770616 & 0.637261 & 0.007017 \\ 0.203250 & 0.256188 & -0.945017 \end{pmatrix}$

# JS65: Parabigyrate Rhombicosidodecahedron



## Model Parameters

Model file:	Parabigyrate_Rhombicosidodecahedron.ply
Sphericity:	0.92459
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.83596
Outscribed-sphere lower bound to the MPF:	0.66075
Oriented-bounding-box lower bound to the MPF:	0.55217

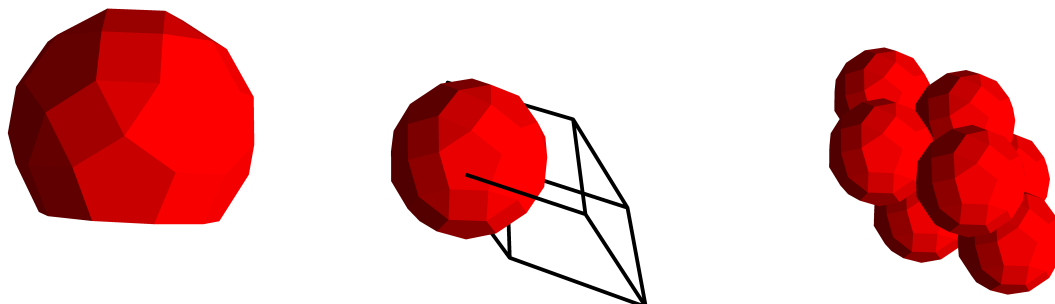
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.80470
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.222400, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.611191, 1.023080, -0.000000\}$ $\mathbf{v3} = \{0.611198, 0.365139, -0.993661\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.237110	0.304719	-0.721273	$\begin{pmatrix} 0.340946 & -0.106279 & -0.934056 \\ -0.019283 & 0.992589 & -0.119978 \\ 0.939885 & 0.058917 & 0.336370 \end{pmatrix}$

# JS66: Paragrate Diminished Rhombicosidodecahedron



## Model Parameters

Model file:	Paragrate_Diminished_Rhombicosidodecahedron.ply
Sphericity:	0.80687
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.62385
Oriented-bounding-box lower bound to the MPF:	0.57791

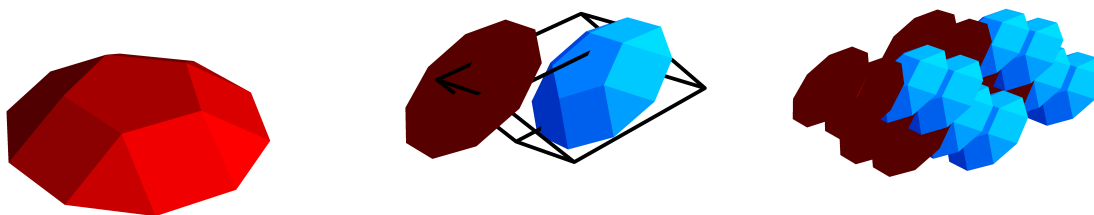
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.82048
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.217010, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.637167, -1.070870, 0.000000\}$ $\mathbf{v3} = \{-0.428464, -0.256144, 0.935190\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.122115	-0.858482	0.727529	$\begin{pmatrix} -0.581643 & 0.731001 & -0.356831 \\ -0.805470 & -0.578840 & 0.127128 \\ -0.113617 & 0.361360 & 0.925478 \end{pmatrix}$

# JS67: Pentagonal Cupola



## Model Parameters

Model file:	Pentagonal_Cupola.ply
Sphericity:	0.16245
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.09698
Oriented-bounding-box lower bound to the MPF:	0.44385

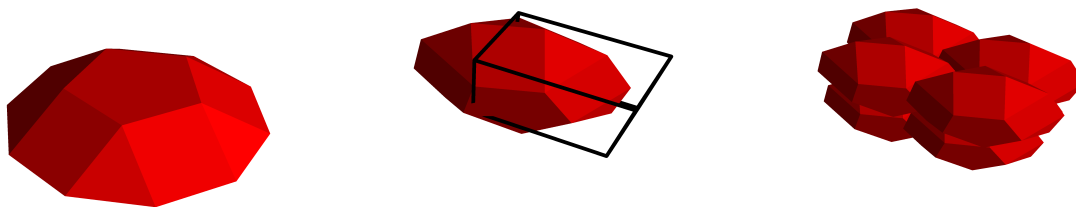
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.85648
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.954728, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-1.010490, -2.555350, 0.000000\}$ $\mathbf{v3} = \{1.085340, 0.334171, -0.957152\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.746779	-1.060430	-0.253877	$\begin{pmatrix} 0.768395 & -0.631798 & 0.101981 \\ 0.486380 & 0.680083 & 0.548563 \\ -0.415937 & -0.371912 & 0.829866 \\ -0.768120 & 0.632078 & -0.102318 \\ 0.486639 & 0.680129 & 0.548276 \\ 0.416143 & 0.371350 & -0.830015 \end{pmatrix}$
2	-0.475679	-2.358870	-0.168238	

# JS68: Pentagonal Gyrobicupola



## Model Parameters

Model file: Pentagonal\_Gyrobicupola.ply  
 Sphericity: 0.32491  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.19397  
 Oriented-bounding-box lower bound to the MPF: 0.44385

## Unit Cell Parameters

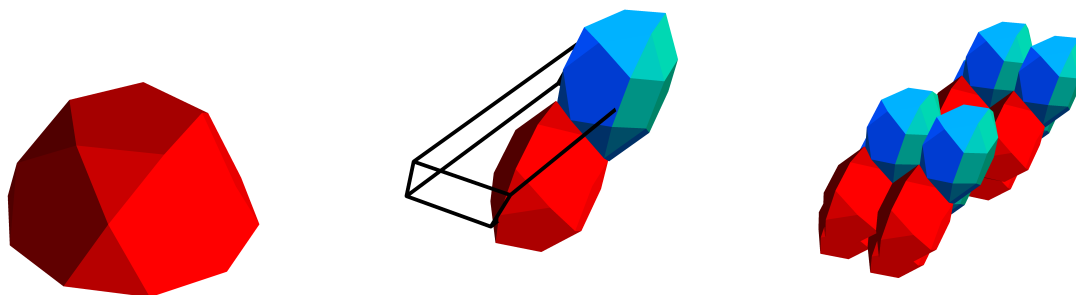
Number of particles: 1  
 Maximum packing fraction (MPF): 0.85891  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.314560, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-0.039746, 0.746356, -0.000000\}$   
 $\mathbf{v3} = \{-0.539909, 0.781245, -1.186710\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.188325	1.027040	-0.857344	$\begin{pmatrix} -0.859492 & -0.442136 & 0.256494 \\ 0.425967 & -0.342188 & 0.837532 \\ -0.282534 & 0.829110 & 0.482443 \end{pmatrix}$



# JS69: Pentagonal Gyrocupolarotunda



## Model Parameters

Model file:	Pentagonal_Gyrocupolarotunda.ply
Sphericity:	0.58777
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.38567
Oriented-bounding-box lower bound to the MPF:	0.48784

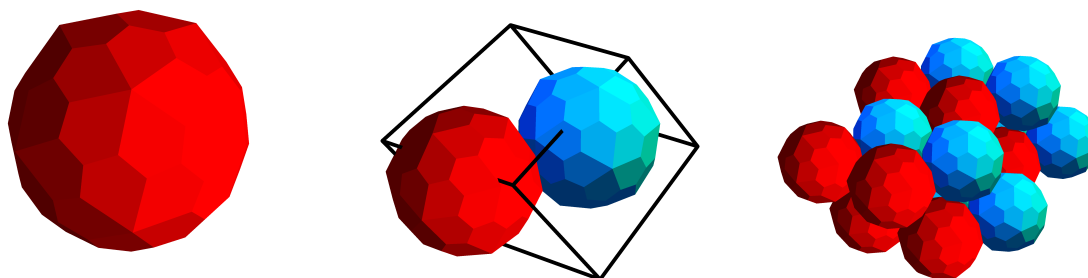
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.84969
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.932154, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.361033, 2.409450, -0.000000\}$ $\mathbf{v3} = \{0.586004, -0.626655, 1.048010\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.483670	1.525550	0.883003	$\begin{pmatrix} -0.194400 & -0.112732 & -0.974423 \\ 0.129277 & -0.987654 & 0.088472 \\ -0.972366 & -0.108771 & 0.206574 \end{pmatrix}$
2	1.057160	0.841989	0.007819	$\begin{pmatrix} -0.233260 & 0.489326 & -0.840327 \\ 0.009679 & 0.865291 & 0.501176 \\ 0.972366 & 0.108771 & -0.206574 \end{pmatrix}$

# CS05: Pentagonal Hexecontahedron



## Model Parameters

Model file: Pentagonal\_Hexecontahedron.ply  
 Sphericity: 0.91886  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 0.78283  
 Outscribed-sphere lower bound to the MPF: 0.60732  
 Oriented-bounding-box lower bound to the MPF: 0.52603

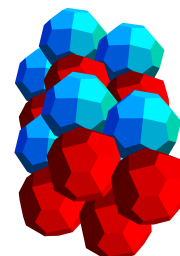
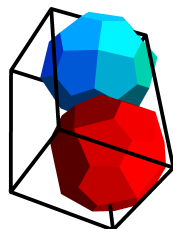
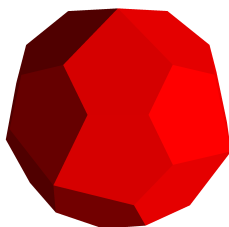
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.74107  
 Particles form a centrosymmetric compound (y/n/-): n  
 Lattice Vectors:  $\mathbf{v1} = \{1.241910, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.001390, 2.138970, -0.000000\}$   
 $\mathbf{v3} = \{0.623660, 0.353890, -1.015950\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.250030	1.314490	-0.366836	$\begin{pmatrix} 0.475680 & 0.833169 & -0.282062 \\ 0.450658 & -0.506219 & -0.735288 \\ -0.755404 & 0.222648 & -0.616273 \end{pmatrix}$
2	0.633286	0.239862	-0.351969	$\begin{pmatrix} 0.312506 & 0.675059 & 0.668308 \\ -0.915341 & 0.025914 & 0.401845 \\ 0.253950 & -0.737308 & 0.626008 \end{pmatrix}$

# CS06: Pentagonal Icositetrahedron



## Model Parameters

Model file:	Pentagonal_Icositetrahedron.ply
Sphericity:	0.85033
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.84856
Outscribed-sphere lower bound to the MPF:	0.52174
Oriented-bounding-box lower bound to the MPF:	0.51407

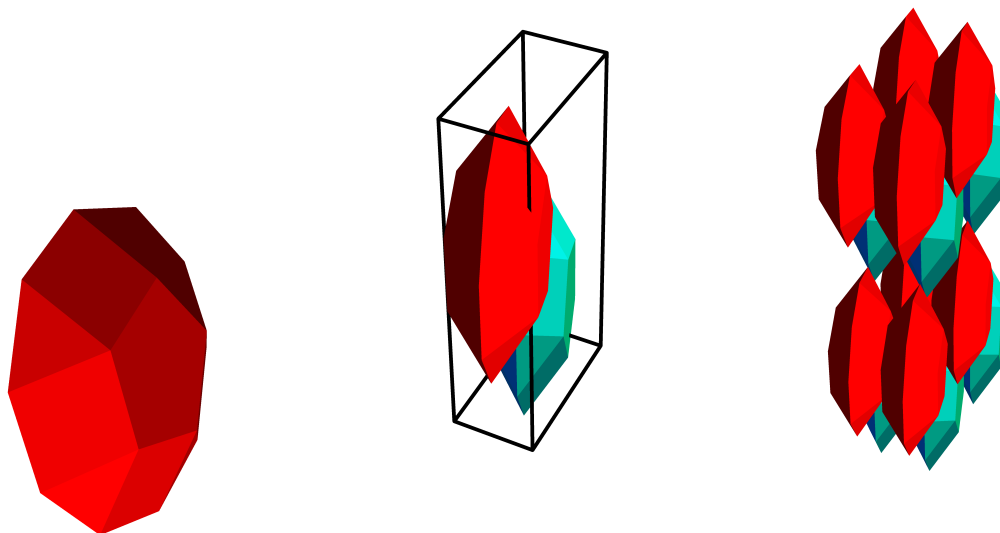
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.74363
Particles form a centrosymmetric compound (y/n/-):	n
Lattice Vectors:	$\mathbf{v1} = \{1.246900, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-1.252880, 1.998890, -0.000000\}$ $\mathbf{v3} = \{-0.623111, -0.001071, -1.079060\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.491381	1.778830	-0.463601	$\begin{pmatrix} 0.287060 & -0.577113 & 0.764550 \\ 0.810166 & 0.572127 & 0.127677 \\ -0.511104 & 0.582762 & 0.631792 \end{pmatrix}$
2	0.135915	0.807376	-0.823326	$\begin{pmatrix} -0.800101 & 0.583293 & 0.140028 \\ -0.528877 & -0.575774 & -0.623517 \\ -0.283069 & -0.572934 & 0.769167 \end{pmatrix}$

# JS70: Pentagonal Orthobicupola



## Model Parameters

Model file:	Pentagonal_Orthobicupola.ply
Sphericity:	0.32491
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.19397
Oriented-bounding-box lower bound to the MPF:	0.44385

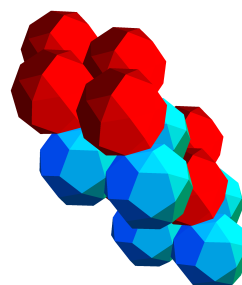
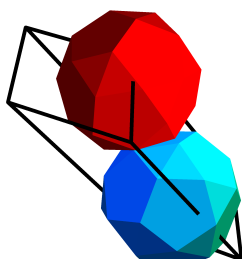
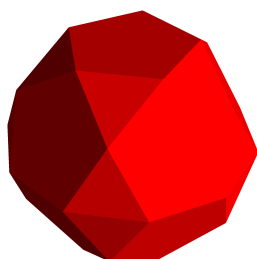
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.82381
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.675059, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.094278, -1.354530, 0.000000\}$ $\mathbf{v3} = \{-0.042021, -0.010491, 2.660210\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.077935	-0.077098	0.343655	$\begin{pmatrix} -0.304955 & 0.762000 & 0.571277 \\ -0.189552 & 0.539285 & -0.820513 \\ -0.933313 & -0.358506 & -0.020019 \\ -0.358130 & 0.933455 & -0.020112 \\ 0.025898 & -0.011601 & -0.999597 \\ -0.933313 & -0.358506 & -0.020019 \end{pmatrix}$
2	0.429539	-1.218590	1.677540	

# JS71: Pentagonal Orthobirotunda



## Model Parameters

Model file:	Pentagonal_Orthobirotunda.ply
Sphericity:	0.85064
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.93800
Outscribed-sphere lower bound to the MPF:	0.57737
Oriented-bounding-box lower bound to the MPF:	0.50464

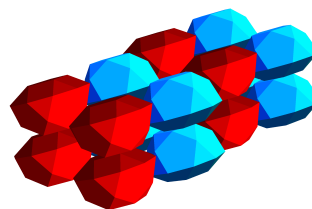
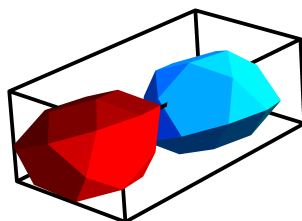
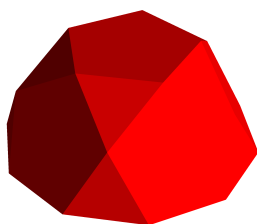
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.81713
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.152280, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.575845, -1.104850, 0.000000\}$ $\mathbf{v3} = \{-0.603124, -1.103710, 1.922530\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.030540	-1.274070	0.617166	$\begin{pmatrix} -0.056677 & 0.807073 & -0.587725 \\ -0.080698 & -0.590449 & -0.803031 \\ -0.995126 & 0.001914 & 0.098594 \end{pmatrix}$
2	0.441025	-0.992487	1.578410	$\begin{pmatrix} 0.056678 & -0.807073 & 0.587725 \\ 0.080698 & 0.590449 & 0.803031 \\ -0.995126 & 0.001914 & 0.098594 \end{pmatrix}$

# JS72: Pentagonal Orthocupolarotunda



## Model Parameters

Model file:	Pentagonal_Orthocupolarotunda.ply
Sphericity:	0.58777
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.38567
Oriented-bounding-box lower bound to the MPF:	0.48784

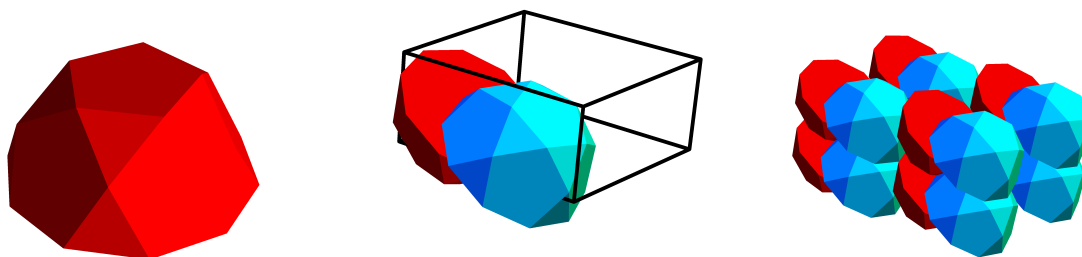
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.83123
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.278840, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.940761, -2.315500, 0.000000\}$ $\mathbf{v3} = \{-0.262664, 0.359047, 0.814917\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.454461	-0.836363	0.514580	$\begin{pmatrix} -0.221792 & -0.950532 & 0.217481 \\ 0.850886 & -0.079733 & 0.519265 \\ -0.476238 & 0.300220 & 0.826478 \end{pmatrix}$
2	-0.237124	-1.977180	0.532758	$\begin{pmatrix} 0.320705 & -0.815862 & 0.481162 \\ -0.818747 & -0.494203 & -0.292262 \\ 0.476238 & -0.300220 & -0.826478 \end{pmatrix}$

# JS73: Pentagonal Rotunda



## Model Parameters

Model file:	Pentagonal_Rotunda.ply
Sphericity:	0.42532
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.28868
Oriented-bounding-box lower bound to the MPF:	0.50464

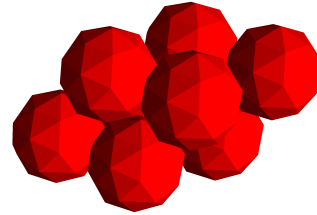
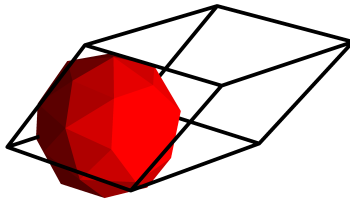
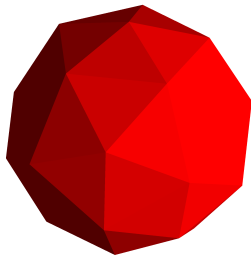
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.85874
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.044400, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.677462, -1.322050, 0.000000\}$ $\mathbf{v3} = \{0.102095, -0.357698, -0.866118\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.766838	-1.294950	-0.646863	$\begin{pmatrix} -0.388193 & 0.912756 & 0.127210 \\ -0.766584 & -0.396431 & 0.505165 \\ 0.511522 & 0.098585 & 0.853596 \end{pmatrix}$
2	-0.107239	-1.197300	-0.818975	$\begin{pmatrix} 0.849023 & 0.094971 & -0.519751 \\ 0.132306 & -0.990586 & 0.035121 \\ -0.511522 & -0.098585 & -0.853596 \end{pmatrix}$

# CS07: Pentakis Dodecahedron



## Model Parameters

Model file: Pentakis\_Dodecahedron.ply  
 Sphericity: 0.91495  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 0.78799  
 Outscribed-sphere lower bound to the MPF: 0.60356  
 Oriented-bounding-box lower bound to the MPF: 0.53419

## Unit Cell Parameters

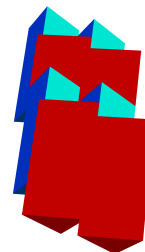
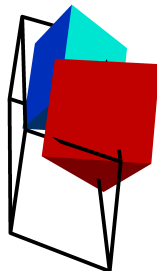
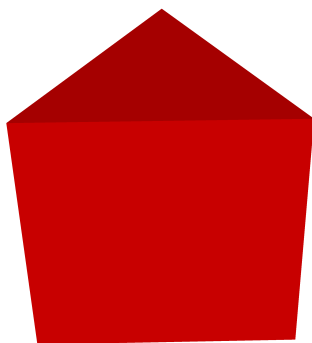
Number of particles: 1  
 Maximum packing fraction (MPF): 0.75755  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.227900, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.653586, 1.075980, -0.000000\}$   
 $\mathbf{v3} = \{0.605567, 0.380213, 0.999125\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.595638	0.676999	0.007568	$\begin{pmatrix} -0.375172 & -0.799235 & -0.469542 \\ 0.892870 & -0.447683 & 0.048609 \\ -0.249055 & -0.401003 & 0.881571 \end{pmatrix}$



# RP03: Prism 3



## Model Parameters

Model file:	Prism_3.ply
Sphericity:	0.37796
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.17181
Oriented-bounding-box lower bound to the MPF:	0.50000

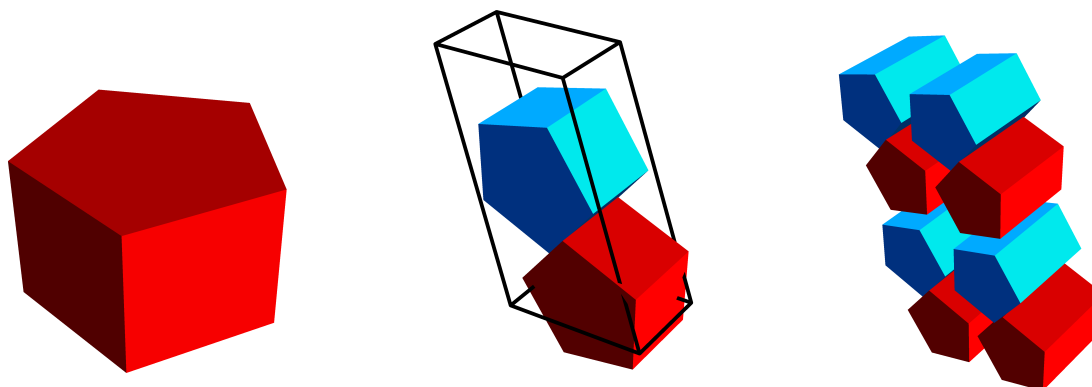
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	1.00000
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.302360, 0.000000, -0.000000\}$ $\mathbf{v2} = \{1.407900, -2.326600, 0.000000\}$ $\mathbf{v3} = \{-0.402805, 1.071850, 0.660343\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.871096	0.235808	0.531583	$\begin{pmatrix} 0.128137 & -0.484833 & 0.865169 \\ 0.943780 & 0.327654 & 0.043834 \\ -0.304728 & 0.810913 & 0.499561 \end{pmatrix}$
2	1.745490	-0.561403	0.585579	$\begin{pmatrix} -0.128153 & 0.484877 & -0.865142 \\ -0.943769 & -0.327685 & -0.043854 \\ -0.304757 & 0.810874 & 0.499606 \end{pmatrix}$

# RP05: Prism 5



## Model Parameters

Model file:	Prism.5.ply
Sphericity:	0.50673
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.31659
Oriented-bounding-box lower bound to the MPF:	0.69098

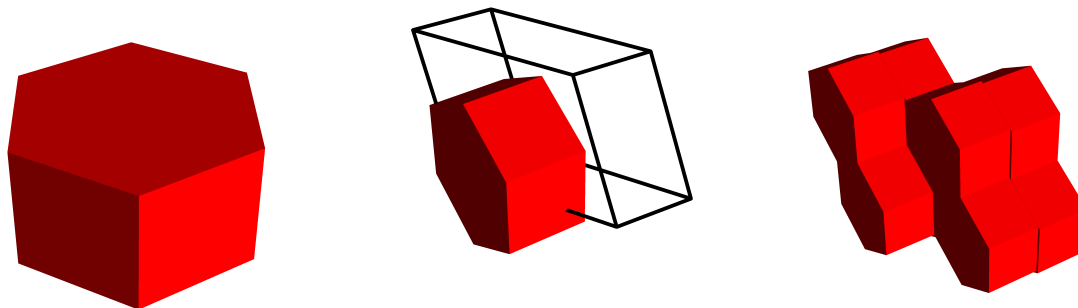
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.92131
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.302930, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.140667, -0.822606, 0.000000\}$ $\mathbf{v3} = \{-1.175780, 0.771395, 2.025530\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.104884	0.030260	1.067040	$\begin{pmatrix} -0.802683 & 0.137260 & 0.580396 \\ -0.572092 & 0.097828 & -0.814335 \\ -0.168555 & -0.985692 & 0.000000 \\ -0.313117 & 0.053543 & 0.948204 \\ 0.934637 & -0.159824 & 0.317662 \\ 0.168555 & 0.985692 & -0.000000 \end{pmatrix}$
2	0.553913	-0.189544	0.051043	

# RP06: Prism 6



## Model Parameters

Model file: Prism\_6.ply  
 Sphericity: 0.44721  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.32863  
 Oriented-bounding-box lower bound to the MPF: 0.75000

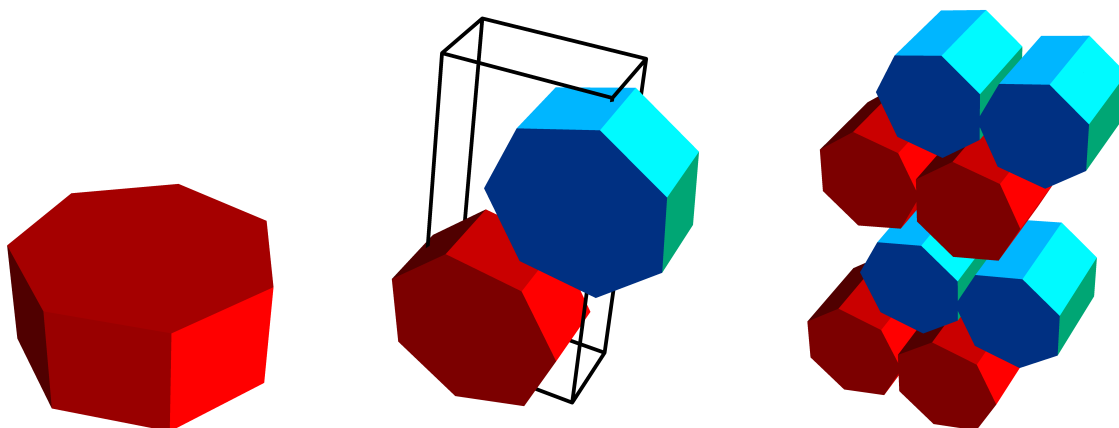
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 1.00000  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.482660, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.384884, 0.618290, -0.000000\}$   
 $\mathbf{v3} = \{-0.560854, 0.287901, 1.090850\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.400316	0.135842	0.161967	$\begin{pmatrix} -0.011034 & -0.019431 & 0.999750 \\ -0.871307 & 0.490739 & -0.000079 \\ -0.490615 & -0.871090 & -0.022345 \end{pmatrix}$

# RP07: Prism 7



## Model Parameters

Model file:	Prism_7.ply
Sphericity:	0.39803
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.32407
Oriented-bounding-box lower bound to the MPF:	0.73825

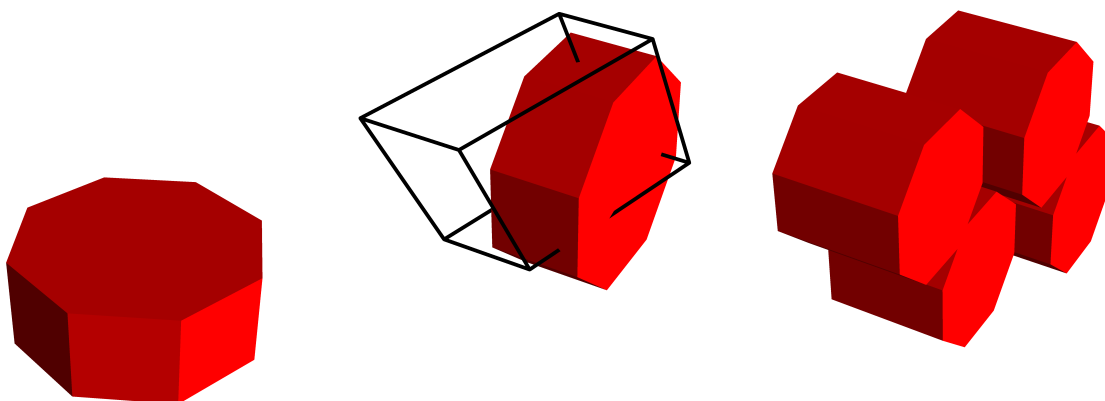
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.89269
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.427290, -0.000000, -0.000000\}$ $\mathbf{v2} = \{0.037702, -0.649348, 0.000000\}$ $\mathbf{v3} = \{-0.035605, 0.628716, 2.417360\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.364810	-0.139617	1.684640	$\begin{pmatrix} 0.900528 & 0.052286 & -0.431643 \\ 0.430917 & 0.025020 & 0.902045 \\ 0.057964 & -0.998319 & 0.000000 \end{pmatrix}$
2	0.607938	-0.468831	0.474820	$\begin{pmatrix} -0.219726 & -0.012758 & -0.975478 \\ 0.973838 & 0.056543 & -0.220097 \\ 0.057964 & -0.998319 & 0.000000 \end{pmatrix}$

# RP08: Prism 8



## Model Parameters

Model file:	Prism.8.ply
Sphericity:	0.35740
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.31175
Oriented-bounding-box lower bound to the MPF:	0.82842

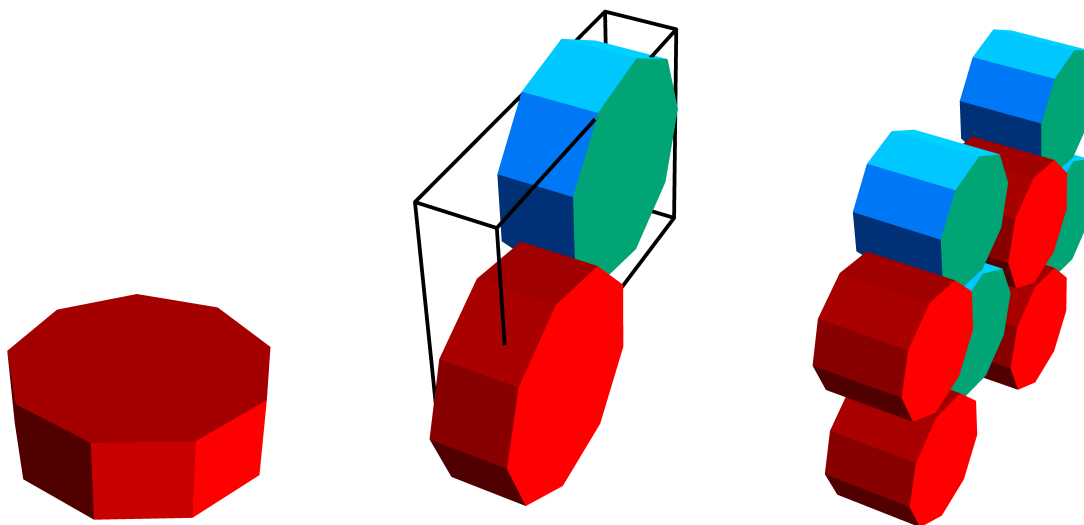
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.90615
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{0.591650, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.387584, -1.428420, 0.000000\}$ $\mathbf{v3} = \{-0.010902, 0.709431, -1.305840\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.095062	0.226652	-1.166100	$\begin{pmatrix} -0.000000 & -0.375211 & 0.926939 \\ 0.000000 & 0.926939 & 0.375211 \\ -1.000000 & 0.000000 & -0.000000 \end{pmatrix}$

# RP09: Prism 9



## Model Parameters

Model file:	Prism_9.ply
Sphericity:	0.32361
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.29629
Oriented-bounding-box lower bound to the MPF:	0.75712

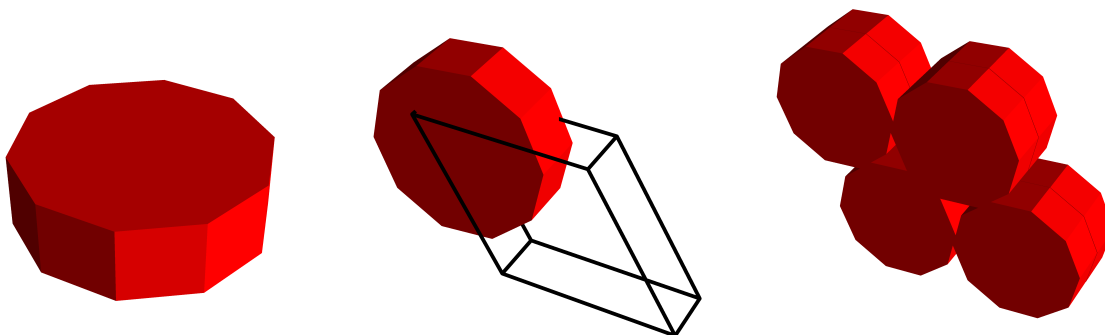
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.90103
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{0.544872, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.112668, 2.616290, -0.000000\}$ $\mathbf{v3} = \{-0.049855, -0.013400, 1.557080\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.180591	1.742940	0.935394	$\begin{pmatrix} -0.000000 & -0.448502 & -0.893782 \\ -0.000000 & -0.893782 & 0.448502 \\ -1.000000 & 0.000000 & 0.000000 \end{pmatrix}$
2	0.447682	0.447419	0.126938	$\begin{pmatrix} 0.000000 & -0.998289 & -0.058477 \\ -0.000000 & -0.058477 & 0.998289 \\ -1.000000 & -0.000000 & -0.000000 \end{pmatrix}$

# RP10: Prism 10



## Model Parameters

Model file:	Prism_10.ply
Sphericity:	0.29524
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.28003
Oriented-bounding-box lower bound to the MPF:	0.77254

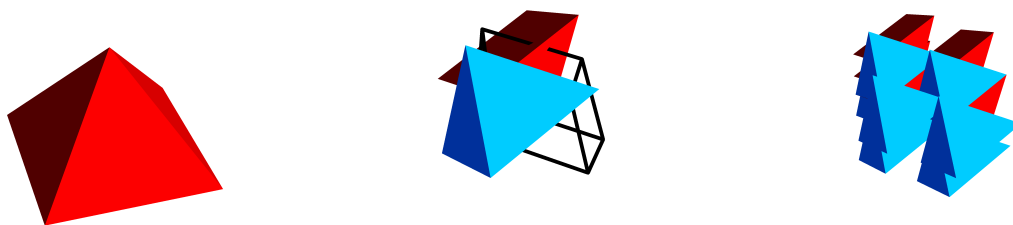
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.91371
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.593880, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.003839, -0.506553, 0.000000\}$ $\mathbf{v3} = \{-0.824073, 0.010272, 1.355650\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.454122	-0.202490	1.048220	$\begin{pmatrix} -0.406500 & 0.006924 & 0.913625 \\ -0.913651 & -0.003083 & -0.406488 \\ 0.000002 & -0.999971 & 0.007579 \end{pmatrix}$

# JS74: Pyramid 4



## Model Parameters

Model file:	Pyramid_4.ply
Sphericity:	0.36601
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.11785
Oriented-bounding-box lower bound to the MPF:	0.33333

## Unit Cell Parameters

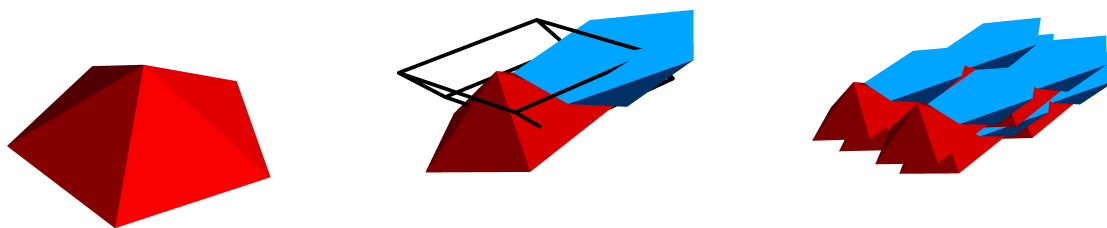
Number of particles:	2
Maximum packing fraction (MPF):	0.94582
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.439120, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.893334, -1.318370, 0.000000\}$ $\mathbf{v3} = \{-0.412353, 0.582458, -1.114520\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.012730	-1.220940	-0.039228	$\begin{pmatrix} -0.238479 & 0.967228 & -0.087163 \\ -0.795639 & -0.246056 & -0.553548 \\ -0.556854 & -0.062659 & 0.828243 \end{pmatrix}$
2	0.438203	0.133671	-0.513613	$\begin{pmatrix} -0.795445 & -0.246128 & -0.553794 \\ -0.238495 & 0.967212 & -0.087304 \\ 0.557124 & 0.062632 & -0.828064 \end{pmatrix}$



# JS75: Pyramid 5



## Model Parameters

Model file: Pyramid\_5.ply  
 Sphericity: 0.27365  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.08658  
 Oriented-bounding-box lower bound to the MPF: 0.23032

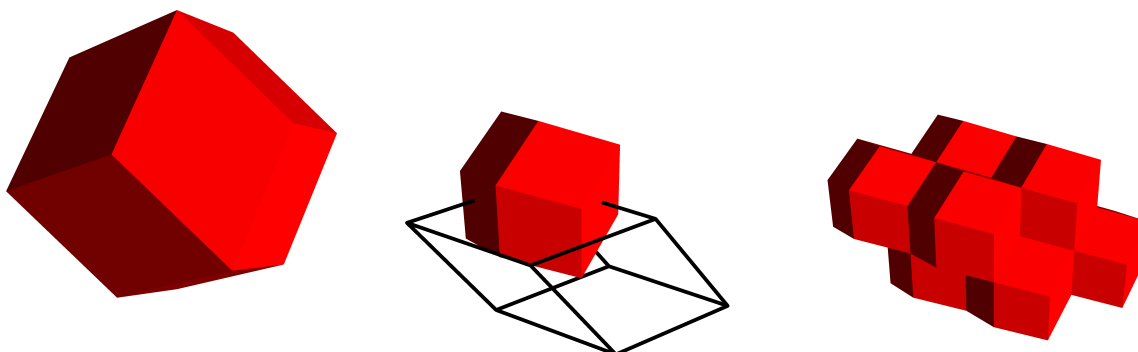
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.80887  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.570790, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.832578, 1.764660, -0.000000\}$   
 $\mathbf{v3} = \{0.002213, 0.827904, -0.892007\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.959210	1.714580	-0.295799	$\begin{pmatrix} 0.069680 & -0.996024 & 0.055498 \\ -0.938582 & -0.084305 & -0.334599 \\ 0.337948 & -0.028774 & -0.940725 \\ -0.914177 & 0.227610 & -0.335372 \\ -0.223768 & -0.973327 & -0.050616 \\ -0.337948 & 0.028774 & 0.940725 \end{pmatrix}$
2	0.944544	0.895122	-0.840887	

# CS08: Rhombic Dodecahedron



## Model Parameters

Model file:	Rhombic_Dodecahedron.ply
Sphericity:	0.70710
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.35355
Oriented-bounding-box lower bound to the MPF:	0.50000

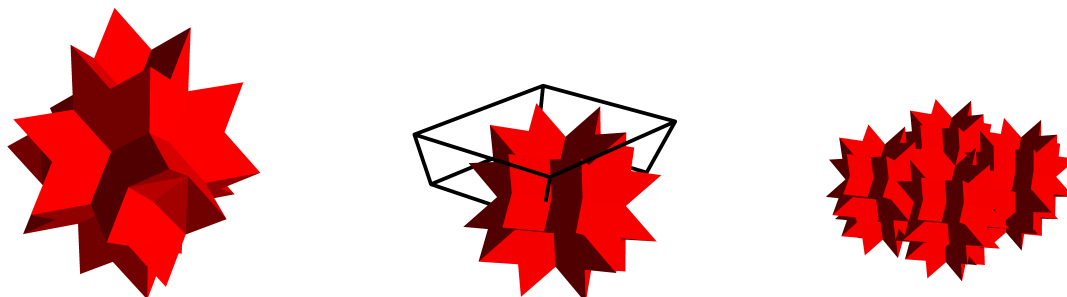
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	1.00000
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.122460, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.561231, 0.972081, 0.000000\}$ $\mathbf{v3} = \{-0.561231, -0.324027, 0.916486\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.092738	0.616501	0.845970	$\begin{pmatrix} -1.000000 & -0.000064 & 0.000204 \\ -0.000130 & -0.577441 & -0.816432 \\ 0.000171 & -0.816432 & 0.577441 \end{pmatrix}$

# PH08: Rhombic Dodecahedron Stellation 2



## Model Parameters

Model file:	Rhombic.Dodecahedron_Stellation_2.ply
Sphericity:	0.35355
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.14378
Oriented-bounding-box lower bound to the MPF:	0.20246

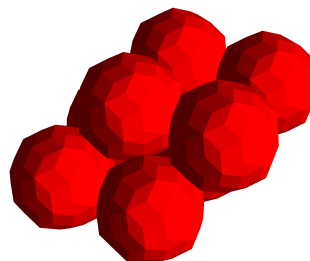
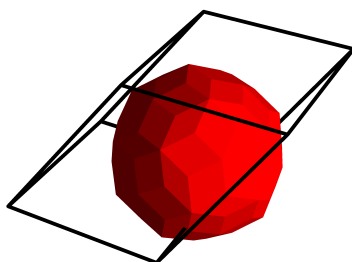
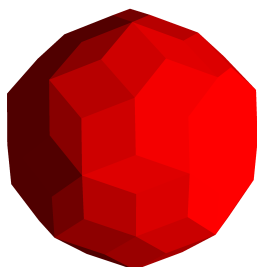
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.59998
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.206250, -0.000000, -0.000000\}$ $\mathbf{v2} = \{0.526673, 1.158280, 0.000000\}$ $\mathbf{v3} = \{-0.509684, 0.833322, -1.192920\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.886823	0.823870	-0.885584	$\begin{pmatrix} -0.949425 & -0.309854 & -0.050811 \\ 0.237356 & -0.602301 & -0.762165 \\ 0.205557 & -0.735679 & 0.645386 \end{pmatrix}$

# MS03: Rhombic Enneacotahedron



## Model Parameters

Model file:	Rhombic_Enneacotahedron.ply
Sphericity:	0.91286
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.79473
Outscribed-sphere lower bound to the MPF:	0.60457
Oriented-bounding-box lower bound to the MPF:	0.54914

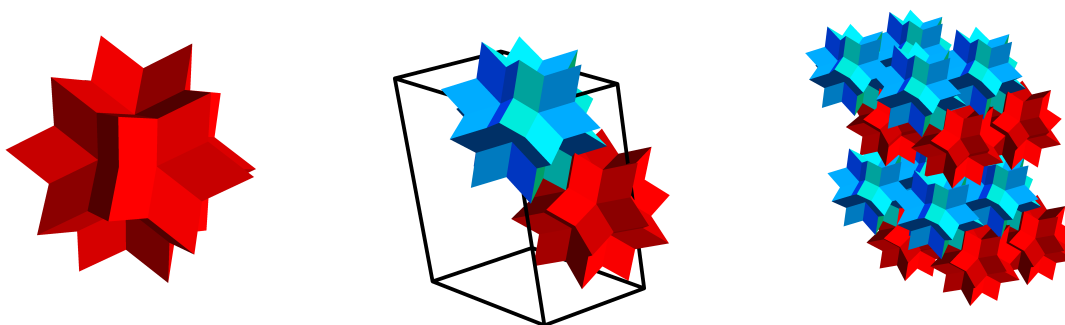
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.79473
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.211800, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.000000, -1.211800, 0.000000\}$ $\mathbf{v3} = \{0.605899, 0.605899, 0.856871\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.020400	-0.269731	0.209242	$\begin{pmatrix} 0.456470 & -0.612413 & -0.645434 \\ 0.353544 & 0.790538 & -0.500057 \\ 0.816481 & 0.000071 & 0.577372 \end{pmatrix}$

# PH09: Rhombic Hexecontahedron



## Model Parameters

Model file:	Rhombic_Hexecontahedron.ply
Sphericity:	0.41946
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.19854
Oriented-bounding-box lower bound to the MPF:	0.19253

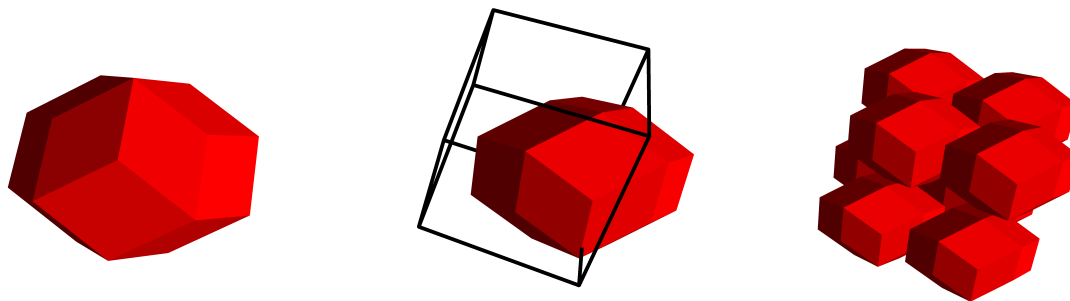
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.55654
Particles form a centrosymmetric compound (y/n/-):	n
Lattice Vectors:	$\mathbf{v1} = \{1.489410, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.743997, 1.077790, -0.000000\}$ $\mathbf{v3} = \{0.745589, -0.621067, -2.238620\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.504620	0.276936	-0.213201	$\begin{pmatrix} 0.595098 & -0.570274 & -0.566256 \\ 0.146772 & -0.615630 & 0.774246 \\ -0.790137 & -0.543863 & -0.282660 \end{pmatrix}$
2	2.249420	0.505297	-1.332510	$\begin{pmatrix} -0.270022 & 0.961758 & -0.045934 \\ 0.377885 & 0.061975 & -0.923776 \\ -0.885602 & -0.266798 & -0.380168 \end{pmatrix}$

# MS04: Rhombic Icosahedron



## Model Parameters

Model file:	Rhombic_Icosahedron.ply
Sphericity:	0.64945
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.34650
Oriented-bounding-box lower bound to the MPF:	0.52786

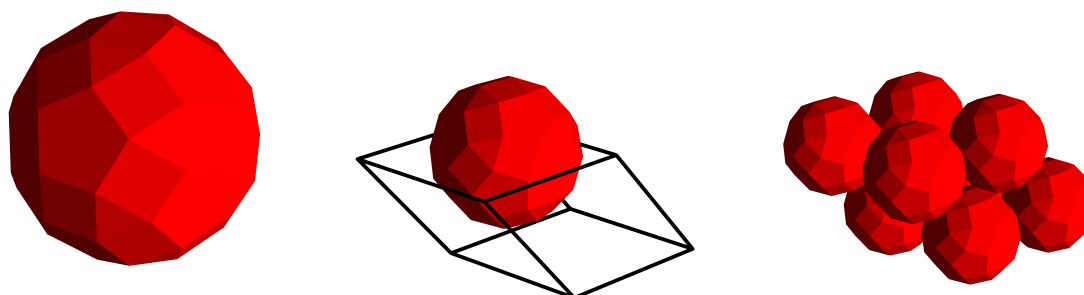
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.82280
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.237120, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.421963, -0.972464, 0.000000\}$ $\mathbf{v3} = \{-0.249586, -0.387800, -1.010220\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.020660	-0.564363	-0.782639	$\begin{pmatrix} 0.205666 & 0.624576 & -0.753396 \\ 0.904433 & 0.172724 & 0.390087 \\ 0.373769 & -0.761624 & -0.529364 \end{pmatrix}$

# AS05: Rhombicosidodecahedron



## Model Parameters

Model file: Rhombicosidodecahedron.ply  
 Sphericity: 0.92459  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 0.83596  
 Outscribed-sphere lower bound to the MPF: 0.66075  
 Oriented-bounding-box lower bound to the MPF: 0.54747

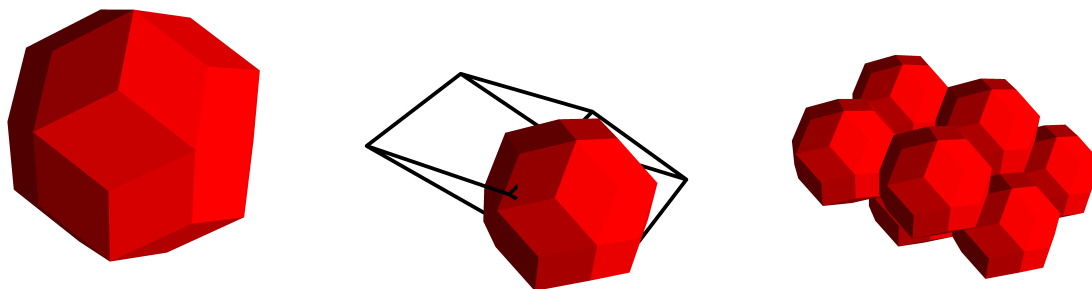
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.80470  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.191710, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-0.626882, -1.049420, 0.000000\}$   
 $\mathbf{v3} = \{0.626875, 0.337476, -0.993677\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.306665	-0.263598	-0.099192	$\begin{pmatrix} -0.010043 & 0.005868 & -0.999932 \\ -0.857587 & 0.514208 & 0.011631 \\ 0.514241 & 0.857646 & -0.000132 \end{pmatrix}$

# CS09: Rhombic Triacontahedron



## Model Parameters

Model file:	Rhombic_Triacontahedron.ply
Sphericity:	0.85064
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.83462
Outscribed-sphere lower bound to the MPF:	0.51374
Oriented-bounding-box lower bound to the MPF:	0.59016

## Unit Cell Parameters

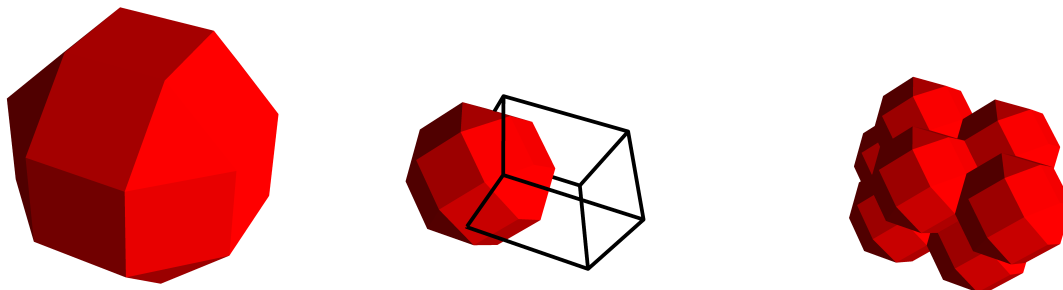
Number of particles:	1
Maximum packing fraction (MPF):	0.80174
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.219330, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.045774, 1.216460, -0.000000\}$ $\mathbf{v3} = \{0.631677, 0.607331, -0.840953\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.397580	0.546895	-0.389431	$\begin{pmatrix} 0.476060 & -0.726817 & -0.495080 \\ 0.105400 & 0.606065 & -0.788401 \\ 0.873074 & 0.323145 & 0.365130 \end{pmatrix}$



# AS09: Rhombicuboctahedron



## Model Parameters

Model file: Rhombicuboctahedron.ply  
 Sphericity: 0.86285  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 0.87580  
 Outscribed-sphere lower bound to the MPF: 0.56262  
 Oriented-bounding-box lower bound to the MPF: 0.61928

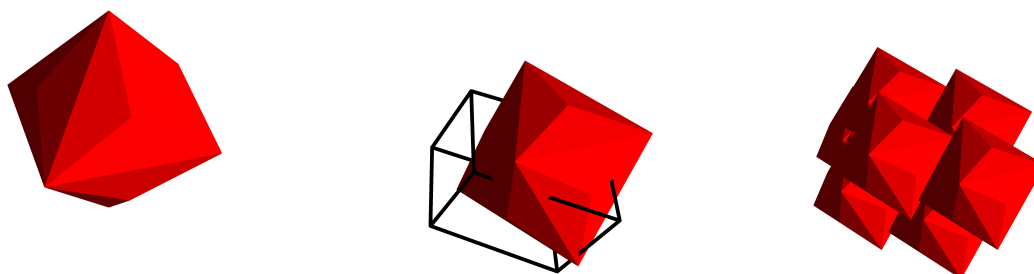
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.87580  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.173190, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-0.586596, 1.016010, -0.000000\}$   
 $\mathbf{v3} = \{0.586596, -0.338672, 0.957907\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.187865	0.549253	0.148115	$\begin{pmatrix} 0.000928 & -0.816540 & 0.577289 \\ 0.706885 & 0.408868 & 0.577183 \\ -0.707328 & 0.407542 & 0.577579 \end{pmatrix}$

# CS10: Small Triakis Octahedron



## Model Parameters

Model file: Small\_Triakis\_Octahedron.ply  
 Sphericity: 0.67859  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 0.93728  
 Outscribed-sphere lower bound to the MPF: 0.29289  
 Oriented-bounding-box lower bound to the MPF: 0.63158

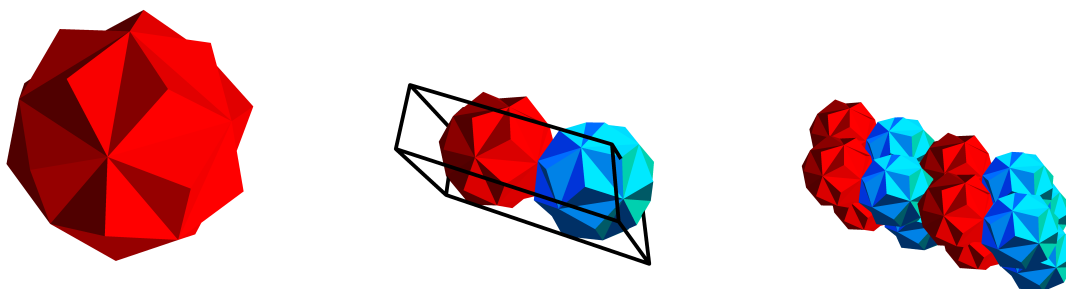
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.87601  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.210360, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.598419, -0.991765, 0.000000\}$   
 $\mathbf{v3} = \{0.594977, -0.249892, 0.950963\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.592110	-0.710927	0.842590	$\begin{pmatrix} 0.849419 & 0.332200 & 0.410036 \\ 0.525048 & -0.453935 & -0.719908 \\ -0.053024 & 0.826793 & -0.560002 \end{pmatrix}$

# PH10: Small Triambic Icosahedron



## Model Parameters

Model file:	Small_Triambic_Icosahedron.ply
Sphericity:	0.79787
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.97719
Outscribed-sphere lower bound to the MPF:	0.49635
Oriented-bounding-box lower bound to the MPF:	0.47293

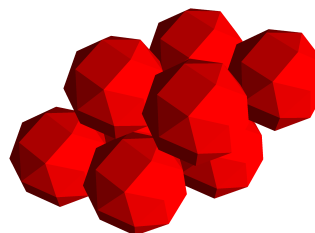
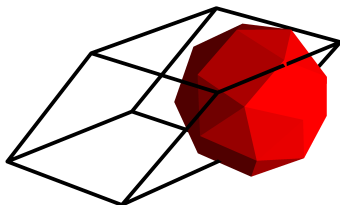
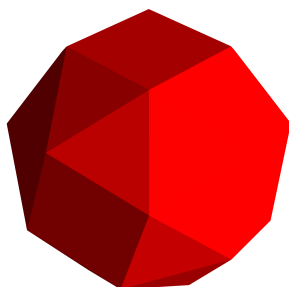
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.69528
Particles form a centrosymmetric compound (y/n/-):	n
Lattice Vectors:	$\mathbf{v1} = \{2.463510, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.581759, 1.112980, -0.000000\}$ $\mathbf{v3} = \{-0.065220, -0.739738, 1.049120\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.460750	0.774185	0.206118	$\begin{pmatrix} 0.561909 & -0.826324 & -0.038049 \\ 0.574098 & 0.422683 & -0.701250 \\ 0.595542 & 0.372194 & 0.711900 \\ 0.585687 & 0.797521 & -0.144673 \\ -0.774680 & 0.603290 & 0.189504 \\ 0.238413 & 0.001085 & 0.971163 \end{pmatrix}$
2	0.228992	0.774185	0.206118	

# AS03: Snub Cube



## Model Parameters

Model file:	Snub_Cube.ply
Sphericity:	0.85033
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.93492
Outscribed-sphere lower bound to the MPF:	0.57484
Oriented-bounding-box lower bound to the MPF:	0.66109

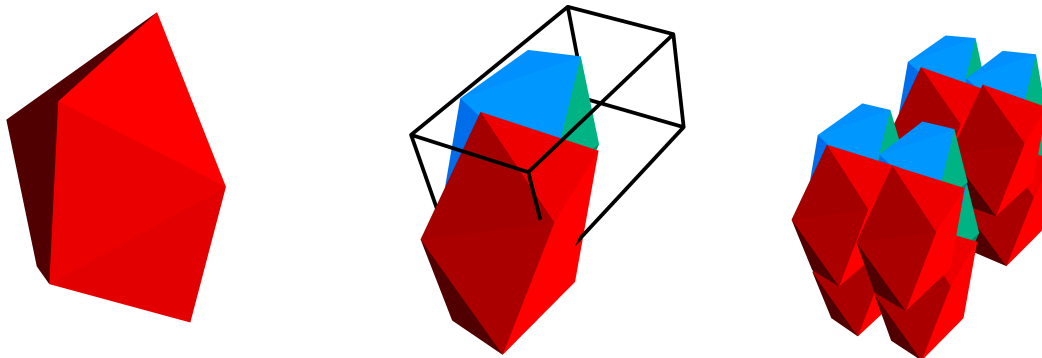
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.78769
Particles form a centrosymmetric compound (y/n/-):	n
Lattice Vectors:	$\mathbf{v1} = \{1.147930, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.574706, -1.123320, 0.000000\}$ $\mathbf{v3} = \{-0.574686, -0.533044, -0.984590\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.553067	-0.377372	-0.541556	$\begin{pmatrix} 0.001884 & 0.862409 & 0.506209 \\ -0.000183 & -0.506210 & 0.862410 \\ 0.999998 & -0.001718 & -0.000796 \end{pmatrix}$

# JS76: Snub Disphenoid



## Model Parameters

Model file:	Snub_Disphenoid.ply
Sphericity:	0.48676
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.18900
Oriented-bounding-box lower bound to the MPF:	0.65970

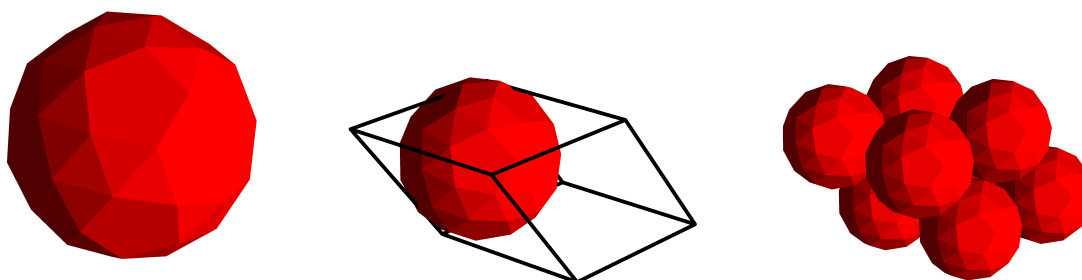
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.86477
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.959916, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.130149, -2.232730, -0.000000\}$ $\mathbf{v3} = \{-0.042046, -0.313672, 1.080650\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.058612	-1.057880	0.105339	$\begin{pmatrix} -0.671703 & -0.574552 & 0.467659 \\ 0.740820 & -0.521385 & 0.423489 \\ 0.000514 & 0.630910 & 0.775856 \end{pmatrix}$
2	0.417218	-2.177950	0.127497	$\begin{pmatrix} 0.671703 & 0.574552 & -0.467659 \\ 0.740820 & -0.521385 & 0.423489 \\ -0.000514 & -0.630910 & -0.775856 \end{pmatrix}$

# AS04: Snub Dodecahedron



## Model Parameters

Model file:	Snub_Dodecahedron.ply
Sphericity:	0.91886
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.85547
Outscribed-sphere lower bound to the MPF:	0.66367
Oriented-bounding-box lower bound to the MPF:	0.53018

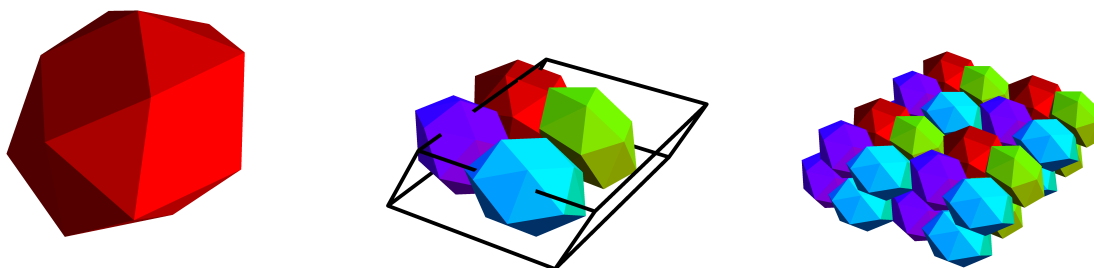
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.78864
Particles form a centrosymmetric compound (y/n/-):	n
Lattice Vectors:	$\mathbf{v1} = \{1.182430, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.519877, -1.062010, 0.000000\}$ $\mathbf{v3} = \{0.519876, 0.324333, -1.011270\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.102166	-0.299434	-0.525146	$\begin{pmatrix} 0.305610 & 0.190688 & 0.932867 \\ 0.529276 & -0.848449 & 0.000039 \\ 0.791498 & 0.493732 & -0.360221 \end{pmatrix}$

# JS77: Snub Square Antiprism



## Model Parameters

Model file: Snub\_Square\_Antiprism.ply  
 Sphericity: 0.55150  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.34434  
 Oriented-bounding-box lower bound to the MPF: 0.52936

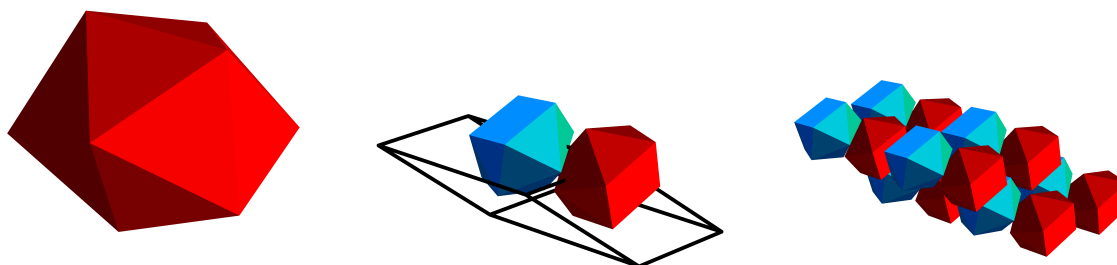
## Unit Cell Parameters

Number of particles: 4  
 Maximum packing fraction (MPF): 0.81981  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:
   
 $\mathbf{v1} = \{2.366900, 0.000000, 0.000000\}$ 
  
 $\mathbf{v2} = \{0.339539, 2.613930, -0.000000\}$ 
  
 $\mathbf{v3} = \{-0.342351, -0.284863, -0.788625\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.438010	1.696810	-0.347465	$\begin{pmatrix} -0.912370 & 0.374390 & 0.165567 \\ -0.372136 & -0.927056 & 0.045630 \\ 0.170573 & -0.019982 & 0.985142 \\ -0.668926 & 0.702165 & 0.243930 \\ 0.742355 & 0.647848 & 0.170886 \\ -0.038039 & 0.295393 & -0.954618 \\ -0.461950 & 0.787733 & 0.407528 \\ 0.787984 & 0.575415 & -0.219040 \\ -0.407043 & 0.219940 & -0.886534 \\ -0.936722 & 0.291378 & -0.194038 \\ -0.256510 & -0.948480 & -0.185982 \\ -0.238232 & -0.124441 & 0.963203 \end{pmatrix}$
2	1.277780	0.403514	-0.313793	
3	0.086561	0.876563	-0.467229	
4	0.246791	2.169860	-0.500902	

# JS78: Sphenocorona



## Model Parameters

Model file:	Sphenocorona.ply
Sphericity:	0.58532
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.27733
Oriented-bounding-box lower bound to the MPF:	0.44893

## Unit Cell Parameters

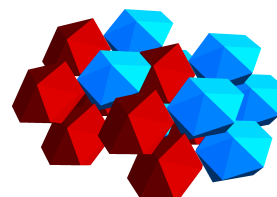
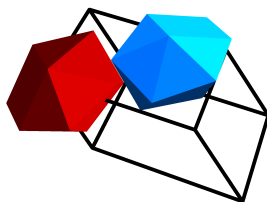
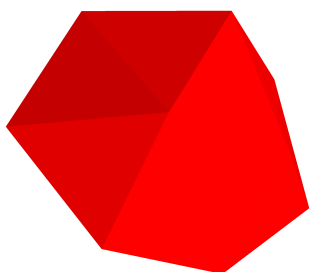
Number of particles:	2
Maximum packing fraction (MPF):	0.82102
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.164130, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.653341, -1.124070, 0.000000\}$ $\mathbf{v3} = \{-1.307110, -0.527043, 1.001370\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.356606	-0.723855	0.916473	$\begin{pmatrix} -0.496345 & 0.399133 & -0.770931 \\ 0.312921 & 0.910600 & 0.269976 \\ 0.809766 & -0.107239 & -0.576869 \end{pmatrix}$
2	0.790965	-0.646199	0.881162	$\begin{pmatrix} 0.496345 & -0.399133 & 0.770931 \\ 0.312921 & 0.910600 & 0.269976 \\ -0.809767 & 0.107240 & 0.576869 \end{pmatrix}$



# JS79: Sphenomegacorona



## Model Parameters

Model file:	Sphenomegacorona.ply
Sphericity:	0.44699
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.16304
Oriented-bounding-box lower bound to the MPF:	0.39771

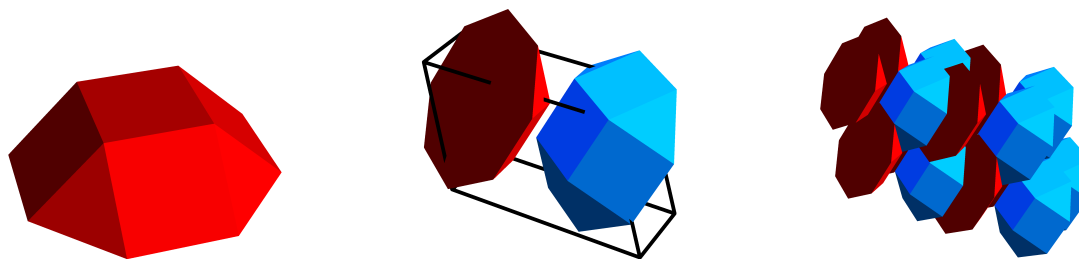
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.85093
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.937150, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.342203, -1.572240, 0.000000\}$ $\mathbf{v3} = \{-0.621785, 0.016027, 0.771703\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.755255	-0.428355	0.719537	$\begin{pmatrix} -0.540403 & 0.461282 & 0.703693 \\ -0.812342 & -0.068115 & -0.579190 \\ -0.219238 & -0.884635 & 0.411528 \end{pmatrix}$
2	-0.128546	-1.367610	0.643804	$\begin{pmatrix} -0.106044 & -0.698439 & 0.707770 \\ 0.957139 & 0.121230 & 0.263038 \\ -0.269518 & 0.705327 & 0.655647 \end{pmatrix}$

# JS80: Square Cupola



## Model Parameters

Model file: Square\_Cupola.ply  
 Sphericity: 0.27059  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.15397  
 Oriented-bounding-box lower bound to the MPF: 0.47140

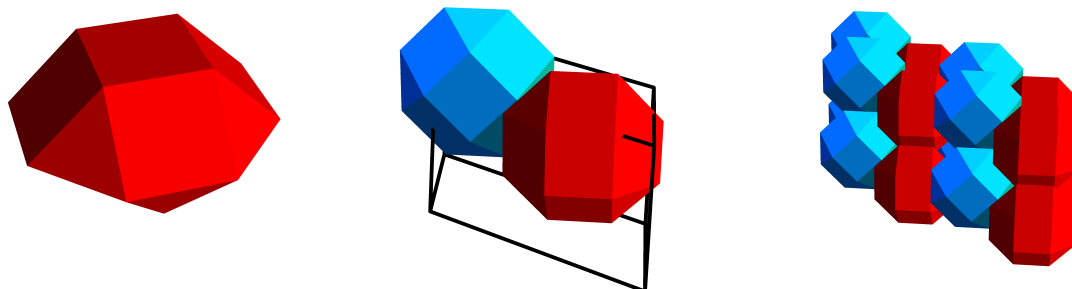
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.94227  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{2.304730, 0.000000, -0.000000\}$   
 $\mathbf{v2} = \{-0.050072, -0.810993, 0.000000\}$   
 $\mathbf{v3} = \{-0.699788, 0.615141, 1.135580\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.339980	-0.061245	0.746771	$\begin{pmatrix} 0.316416 & -0.734263 & -0.600615 \\ 0.811206 & -0.118780 & 0.572569 \\ -0.491758 & -0.668393 & 0.558055 \\ -0.316416 & 0.734263 & 0.600615 \\ 0.811206 & -0.118780 & 0.572569 \\ 0.491757 & 0.668393 & -0.558055 \end{pmatrix}$
2	0.122896	-0.149207	0.820212	

# JS81: Square Gyrobicupola



## Model Parameters

Model file: Square\_Gyrobicupola.ply  
 Sphericity: 0.54119  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.30795  
 Oriented-bounding-box lower bound to the MPF: 0.47140

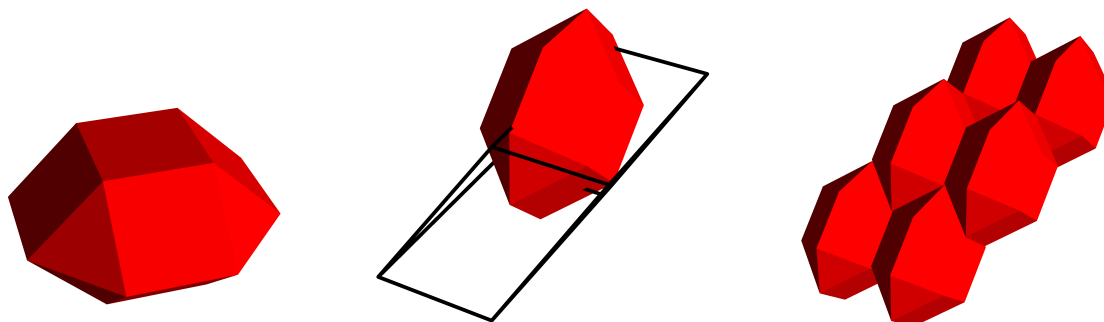
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.82692  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:
   
 $\mathbf{v1} = \{2.363900, -0.000000, 0.000000\}$ 
  
 $\mathbf{v2} = \{0.378528, -0.860157, 0.000000\}$ 
  
 $\mathbf{v3} = \{0.255299, -0.611623, -1.189470\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.750338	-0.681867	-0.071770	$\begin{pmatrix} -0.736627 & -0.092957 & 0.669881 \\ 0.563407 & 0.463565 & 0.683871 \\ -0.374104 & 0.881173 & -0.289102 \end{pmatrix}$
2	1.967780	-0.764240	-0.382866	$\begin{pmatrix} 0.563407 & 0.463565 & 0.683871 \\ -0.736627 & -0.092957 & 0.669880 \\ 0.374104 & -0.881173 & 0.289102 \end{pmatrix}$

# JS82: Square Orthobicupola



## Model Parameters

Model file:	Square_Orthobicupola.ply
Sphericity:	0.54119
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.30795
Oriented-bounding-box lower bound to the MPF:	0.55228

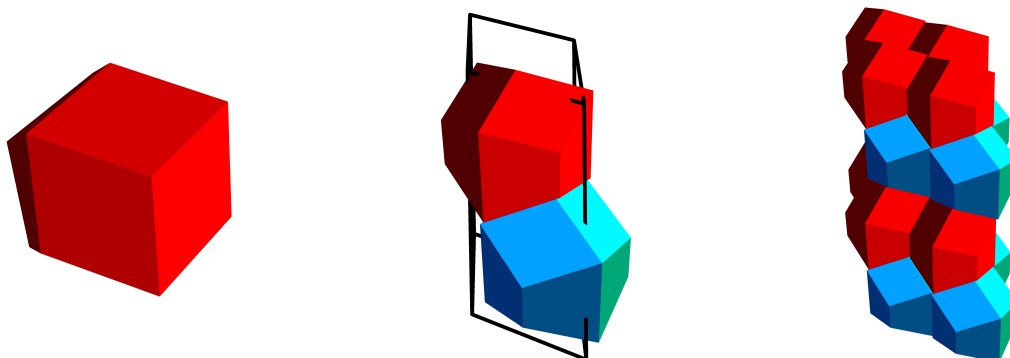
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.94249
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{0.899925, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.020010, 1.543870, -0.000000\}$ $\mathbf{v3} = \{0.468106, 0.771848, 0.763662\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.484896	1.760610	0.424707	$\begin{pmatrix} 0.018426 & 0.004058 & 0.999822 \\ -0.021907 & -0.999750 & 0.004461 \\ 0.999590 & -0.021985 & -0.018333 \end{pmatrix}$

# MS05: Squashed Dodecahedron



## Model Parameters

Model file:	Squashed_Dodecahedron.ply
Sphericity:	0.70710
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.35355
Oriented-bounding-box lower bound to the MPF:	0.50000

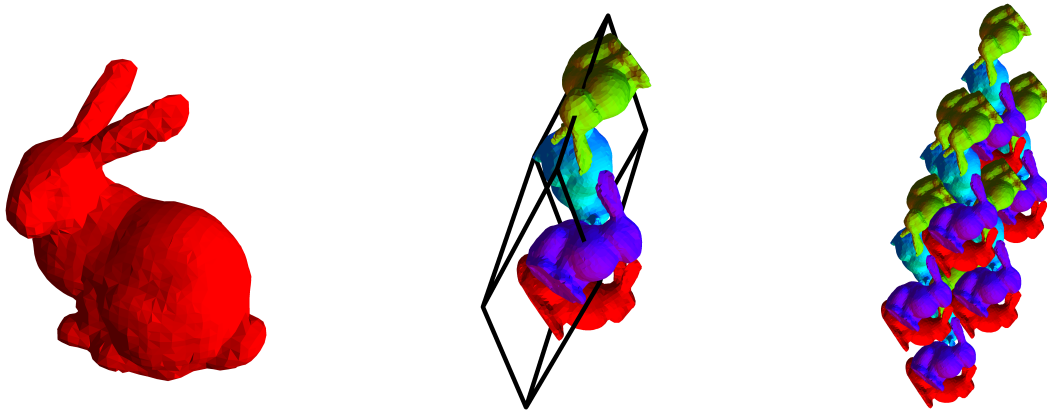
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	1.00000
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.122820, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.561189, 0.972385, 0.000000\}$ $\mathbf{v3} = \{-0.561738, 0.972954, 1.833390\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.564402	0.523144	0.463664	$\begin{pmatrix} 0.707553 & 0.430783 & -0.560174 \\ 0.706206 & -0.402630 & 0.582377 \\ 0.025335 & -0.807661 & -0.589103 \end{pmatrix}$
2	0.002790	0.847557	1.380360	$\begin{pmatrix} 0.706206 & -0.402630 & 0.582377 \\ 0.707553 & 0.430782 & -0.560174 \\ -0.025335 & 0.807661 & 0.589103 \end{pmatrix}$

# MS06: Stanford Bunny



## Model Parameters

Model file:	Stanford_Bunny.ply
Sphericity:	0.41221
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.13380
Oriented-bounding-box lower bound to the MPF:	0.31616

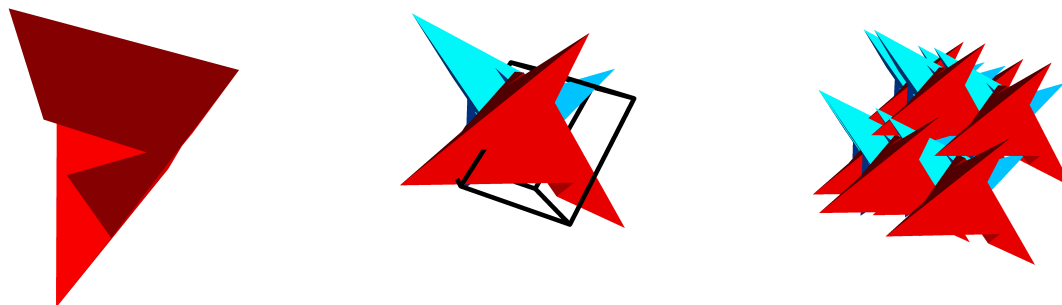
## Unit Cell Parameters

Number of particles:	4
Maximum packing fraction (MPF):	0.70503
Particles form a centrosymmetric compound (y/n/-):	n
Lattice Vectors:	$\mathbf{v1} = \{2.431470, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.871176, 1.560220, -0.000000\}$ $\mathbf{v3} = \{-1.509130, -1.126380, 1.495520\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.819384	-0.684262	1.493060	$\begin{pmatrix} -0.638816 & 0.253076 & -0.726545 \\ 0.245850 & 0.961985 & 0.118922 \\ 0.729022 & -0.102652 & -0.676750 \\ -0.149478 & -0.693733 & 0.704550 \end{pmatrix}$
2	-0.034666	0.229184	0.518091	
3	1.608100	0.220407	1.036620	
4	1.718610	1.116600	0.324951	

# PH11: Szilassi Polyhedron



## Model Parameters

Model file:	Szilassi_Polyhedron.ply
Sphericity:	0.16538
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.03637
Oriented-bounding-box lower bound to the MPF:	0.13732

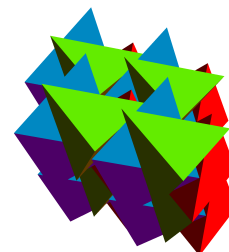
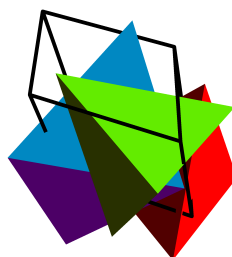
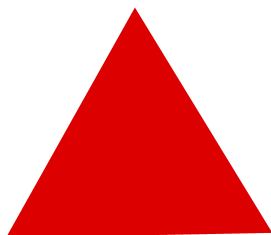
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.51913
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.211850, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.334172, 2.186980, -0.000000\}$ $\mathbf{v3} = \{1.384290, -1.880710, 1.453650\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.550671	0.469131	0.576703	$\begin{pmatrix} 0.821879 & -0.392041 & -0.413302 \\ 0.569662 & 0.565617 & 0.596291 \\ 0.000000 & -0.725522 & 0.688199 \end{pmatrix}$
2	1.385280	-0.362568	1.147150	$\begin{pmatrix} -0.821879 & 0.392041 & 0.413302 \\ 0.569662 & 0.565617 & 0.596291 \\ -0.000000 & 0.725522 & -0.688199 \end{pmatrix}$

# PS01: Tetrahedron



## Model Parameters

Model file:	Tetrahedron.ply
Sphericity:	0.33333
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.09072
Oriented-bounding-box lower bound to the MPF:	0.33333

## Unit Cell Parameters

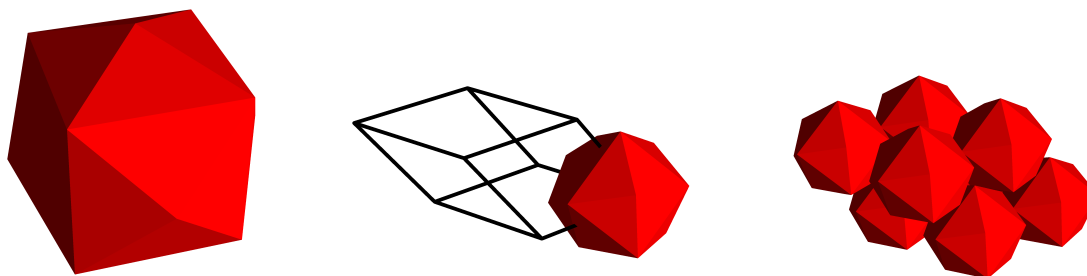
Number of particles:	4
Maximum packing fraction (MPF):	0.85634
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.698270, -0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.813050, 1.570800, -0.000000\}$ $\mathbf{v3} = \{0.229719, -0.967381, 1.754980\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.200280	-0.365296	0.970538	$\begin{pmatrix} -0.976822 & 0.006317 & 0.213961 \\ -0.017220 & 0.994006 & -0.107964 \\ -0.213360 & -0.109146 & -0.970858 \end{pmatrix}$
2	0.475294	0.174766	0.916454	$\begin{pmatrix} -0.503324 & 0.863993 & 0.013481 \\ -0.837342 & -0.491532 & 0.239278 \\ 0.213361 & 0.109146 & 0.970858 \end{pmatrix}$
3	0.297633	0.083882	0.108037	$\begin{pmatrix} -0.560578 & 0.629553 & 0.537974 \\ -0.738176 & -0.085470 & -0.669171 \\ -0.375298 & -0.772242 & 0.512634 \end{pmatrix}$
4	1.148220	0.692970	0.023970	$\begin{pmatrix} 0.358991 & 0.388796 & 0.848507 \\ 0.854563 & -0.502473 & -0.131313 \\ 0.375298 & 0.772242 & -0.512634 \end{pmatrix}$



# CS11: Tetrakis Hexahedron



## Model Parameters

Model file:	Tetrakis_Hexahedron.ply
Sphericity:	0.77459
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.87841
Outscribed-sphere lower bound to the MPF:	0.40824
Oriented-bounding-box lower bound to the MPF:	0.55555

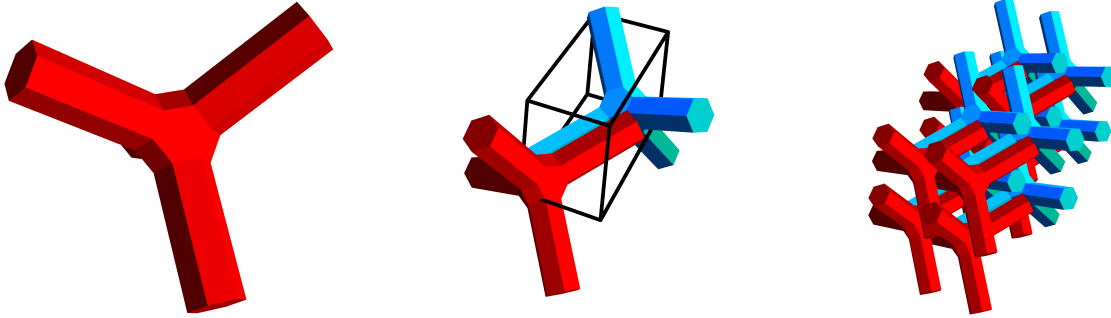
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.81401
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.221200, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.606779, -1.057740, 0.000000\}$ $\mathbf{v3} = \{-0.609133, -0.352533, 0.951037\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.968845	-0.128155	0.040290	$\begin{pmatrix} 0.390376 & -0.430466 & -0.813821 \\ 0.736057 & 0.676901 & -0.004969 \\ 0.553016 & -0.597079 & 0.581094 \end{pmatrix}$

# PA04: Tetrapod



## Model Parameters

Model file:	Tetrapod.ply
Sphericity:	0.20303
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.04864
Oriented-bounding-box lower bound to the MPF:	0.10628

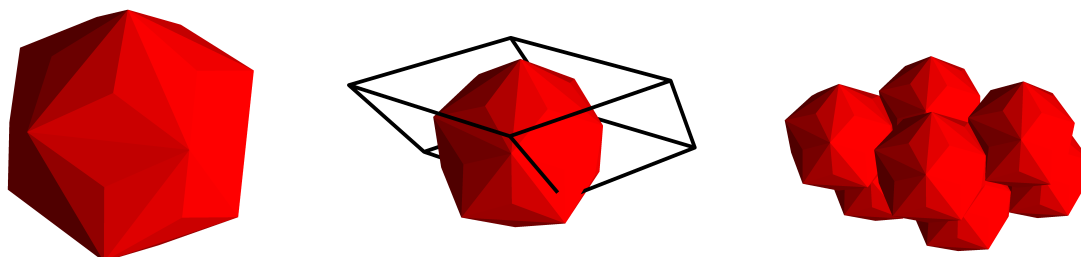
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.59207
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.200440, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.336253, 2.503690, -0.000000\}$ $\mathbf{v3} = \{-0.138403, 0.486549, 1.123920\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.564118	1.961490	0.292156	$\begin{pmatrix} 0.287425 & -0.949803 & 0.123536 \\ 0.912837 & 0.232588 & -0.335607 \\ 0.290027 & 0.209230 & 0.933867 \end{pmatrix}$
2	0.123058	0.297707	0.025395	$\begin{pmatrix} -0.290561 & 0.948728 & -0.124458 \\ -0.289587 & -0.211160 & -0.933569 \\ -0.911983 & -0.235217 & 0.336094 \end{pmatrix}$

# CS12: Triakis Icosahedron



## Model Parameters

Model file:	Triakis_Icosahedron.ply
Sphericity:	0.83850
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.81804
Outscribed-sphere lower bound to the MPF:	0.48227
Oriented-bounding-box lower bound to the MPF:	0.55402

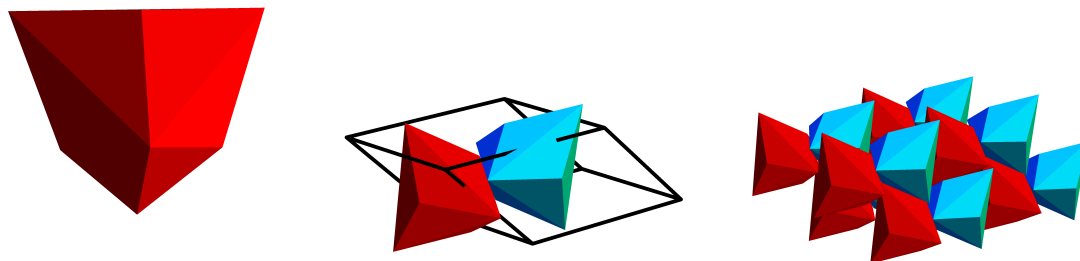
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.80479
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.205120, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.611700, 1.046690, -0.000000\}$ $\mathbf{v3} = \{0.016585, 0.705183, -0.985127\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.724448	0.959944	-0.843599	$\begin{pmatrix} 0.370719 & 0.626669 & 0.685459 \\ -0.860565 & -0.045782 & 0.507278 \\ 0.349277 & -0.777940 & 0.522317 \end{pmatrix}$

# CS13: Triakis Tetrahedron



## Model Parameters

Model file: Triakis\_Tetrahedron.ply  
 Sphericity: 0.52223  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.16329  
 Oriented-bounding-box lower bound to the MPF: 0.59999

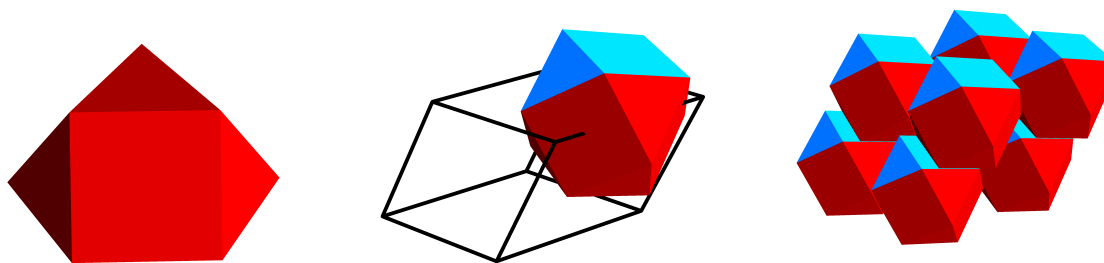
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.79886  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{1.423290, -0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-1.279860, -1.708860, 0.000000\}$   
 $\mathbf{v3} = \{-0.973710, -0.382804, 1.029540\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.315094	-0.972190	0.578109	$\begin{pmatrix} 0.362393 & 0.879234 & -0.309223 \\ -0.056169 & 0.351775 & 0.934398 \\ 0.930331 & -0.321250 & 0.176867 \\ -0.997922 & 0.009800 & -0.063677 \end{pmatrix}$
2	-1.031240	-1.774050	0.412186	

# JS83: Triangular Cupola



## Model Parameters

Model file:	Triangular_Cupola.ply
Sphericity:	0.40824
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.20833
Oriented-bounding-box lower bound to the MPF:	0.41666

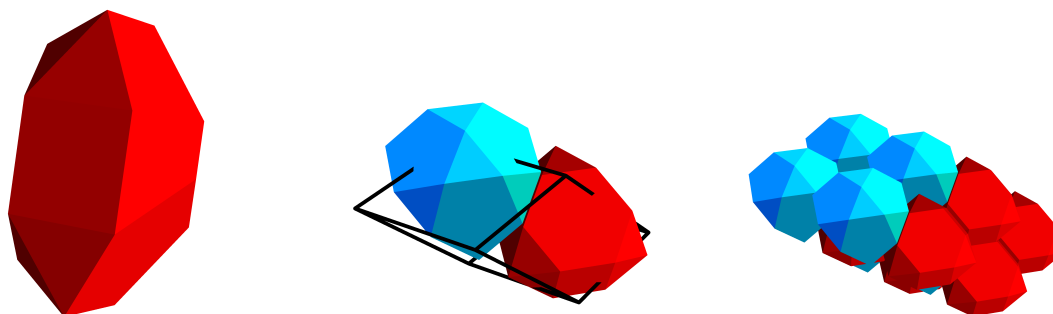
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.91836
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.361320, 0.000000, 0.000000\}$ $\mathbf{v2} = \{0.934326, 1.340170, -0.000000\}$ $\mathbf{v3} = \{-0.339786, -0.560603, -1.199160\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.310390	1.067610	-0.044723	$\begin{pmatrix} -0.249006 & -0.714983 & 0.653295 \\ 0.792090 & 0.237811 & 0.562174 \\ -0.557306 & 0.657453 & 0.507115 \end{pmatrix}$
2	1.633840	0.685476	-0.337059	$\begin{pmatrix} -0.810473 & -0.563442 & -0.160209 \\ -0.180400 & 0.500288 & -0.846857 \\ 0.557306 & -0.657453 & -0.507115 \end{pmatrix}$

# JS84: Triangular Hebesphenorotunda



## Model Parameters

Model file:	Triangular_Hebesphenorotunda.ply
Sphericity:	0.49999
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.26151
Oriented-bounding-box lower bound to the MPF:	0.47213

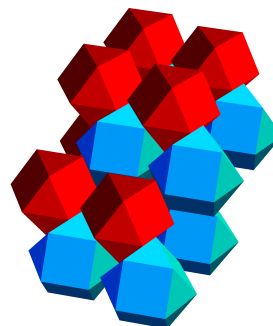
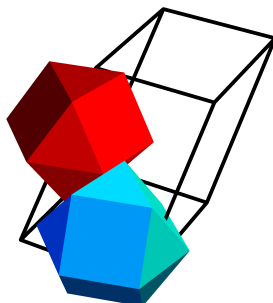
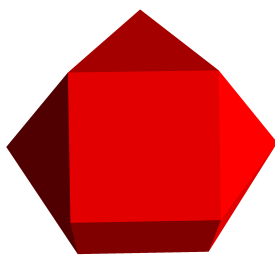
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.87496
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.305870, -0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.196748, -1.439750, 0.000000\}$ $\mathbf{v3} = \{-0.574647, -1.063610, 1.215780\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	-0.311788	-1.265120	0.996192	$\begin{pmatrix} 0.690687 & -0.259185 & 0.675110 \\ -0.495963 & -0.849187 & 0.181391 \\ 0.526281 & -0.460114 & -0.715069 \end{pmatrix}$
2	0.702213	-0.830750	0.425575	$\begin{pmatrix} -0.371425 & 0.202821 & -0.906039 \\ -0.118111 & 0.957599 & 0.262781 \\ 0.920920 & 0.204617 & -0.331721 \end{pmatrix}$

# JS85: Triangular Orthobicupola



## Model Parameters

Model file: Triangular\_Orthobicupola.ply  
 Sphericity: 0.70710  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.41666  
 Oriented-bounding-box lower bound to the MPF: 0.52465

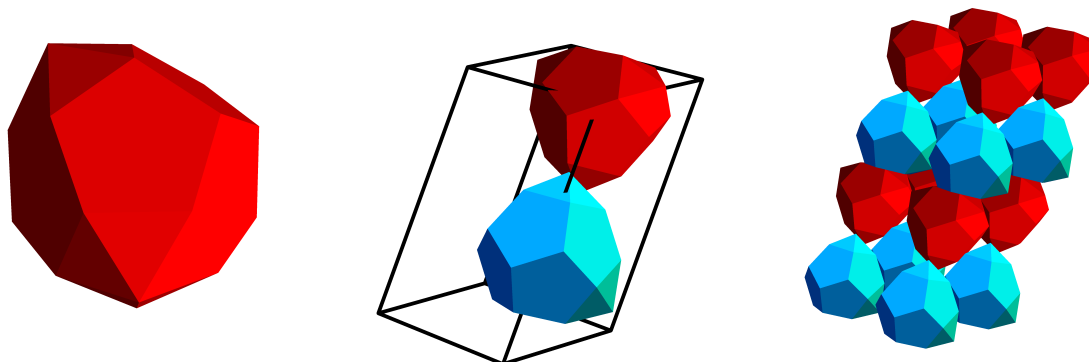
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.88316  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.309840, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.051220, 1.403000, -0.000000\}$   
 $\mathbf{v3} = \{0.068188, 1.412440, 1.232290\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.885377	0.265531	0.187234	$\begin{pmatrix} -0.306252 & 0.951730 & -0.020476 \\ -0.950713 & -0.304687 & 0.057532 \\ 0.048516 & 0.037086 & 0.998134 \end{pmatrix}$
2	0.149125	0.928208	0.790895	$\begin{pmatrix} 0.306252 & -0.951730 & 0.020476 \\ 0.950713 & 0.304687 & -0.057532 \\ 0.048516 & 0.037086 & 0.998134 \end{pmatrix}$

# JS86: Triaugmented Dodecahedron



## Model Parameters

Model file:	Triaugmented_Dodecahedron.ply
Sphericity:	0.69033
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.36090
Oriented-bounding-box lower bound to the MPF:	0.52502

## Unit Cell Parameters

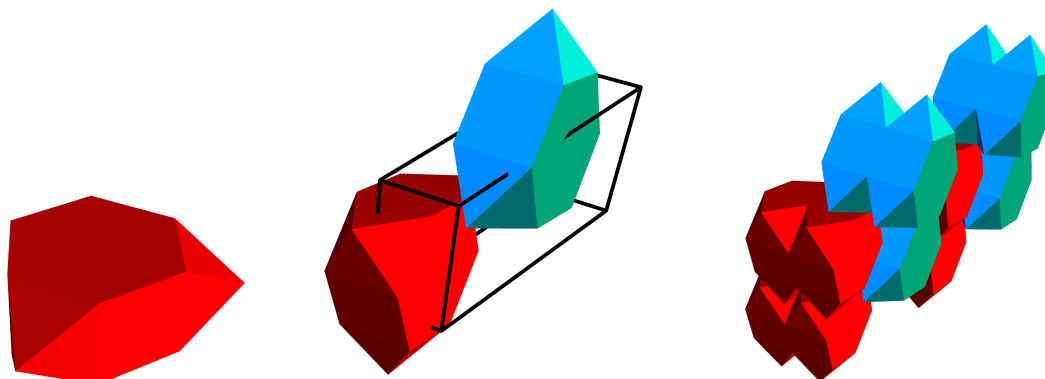
Number of particles:	2
Maximum packing fraction (MPF):	0.87421
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.391190, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.679936, 0.855385, 0.000000\}$ $\mathbf{v3} = \{0.096673, 1.631630, 1.922480\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.379550	0.901684	0.624876	$\begin{pmatrix} -0.624743 & 0.780794 & -0.007572 \\ 0.445746 & 0.364587 & 0.817550 \\ 0.641098 & 0.507383 & -0.575808 \end{pmatrix}$
2	1.328460	2.009550	1.563880	$\begin{pmatrix} -0.661451 & -0.743653 & -0.097282 \\ 0.550535 & -0.393356 & -0.736330 \\ 0.509308 & -0.540603 & 0.669593 \end{pmatrix}$



# JS87: Triaugmented Hexagonal Prism



## Model Parameters

Model file:	Triaugmented_Hexagonal_Prism.ply
Sphericity:	0.31783
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.15008
Oriented-bounding-box lower bound to the MPF:	0.49731

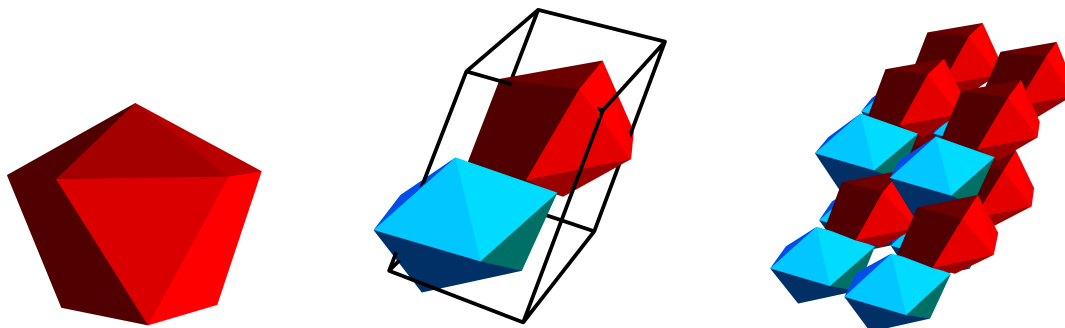
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.89315
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{0.671328, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.512735, 2.129130, -0.000000\}$ $\mathbf{v3} = \{0.335382, -0.250385, 1.566740\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.963734	0.961190	1.424430	$\begin{pmatrix} -0.000543 & 0.757349 & 0.653010 \\ 0.000046 & -0.653010 & 0.757349 \\ 1.000000 & 0.000441 & 0.000320 \end{pmatrix}$
2	0.253998	0.148483	0.476404	$\begin{pmatrix} -0.000411 & 0.757349 & 0.653010 \\ 0.000036 & 0.653010 & -0.757349 \\ -1.000000 & -0.000287 & -0.000295 \end{pmatrix}$

# JS88: Triaugmented Triangular Prism



## Model Parameters

Model file:	Triaugmented_Triangular_Prism.ply
Sphericity:	0.50211
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.20411
Oriented-bounding-box lower bound to the MPF:	0.42377

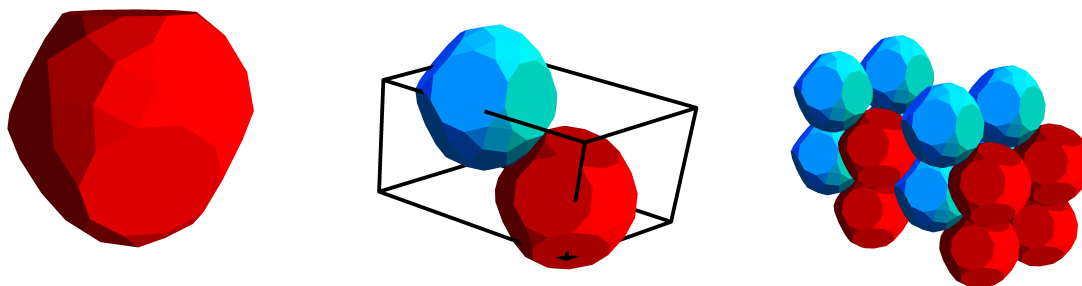
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.82855
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.336630, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.017013, -1.347990, 0.000000\}$ $\mathbf{v3} = \{-0.038822, -1.336870, -1.339700\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.232763	-1.902530	-1.274070	$\begin{pmatrix} -0.815674 & -0.377954 & -0.437981 \\ -0.025899 & -0.732466 & 0.680311 \\ -0.577932 & 0.566255 & 0.587664 \\ 0.815674 & 0.377953 & 0.437981 \\ -0.025900 & -0.732466 & 0.680311 \\ 0.577932 & -0.566255 & -0.587664 \end{pmatrix}$
2	0.816081	-1.120990	-0.493740	

# JS89: Triaugmented Truncated Dodecahedron



## Model Parameters

Model file:	Triaugmented_Truncated_Dodecahedron.ply
Sphericity:	0.79465
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.52875
Oriented-bounding-box lower bound to the MPF:	0.53355

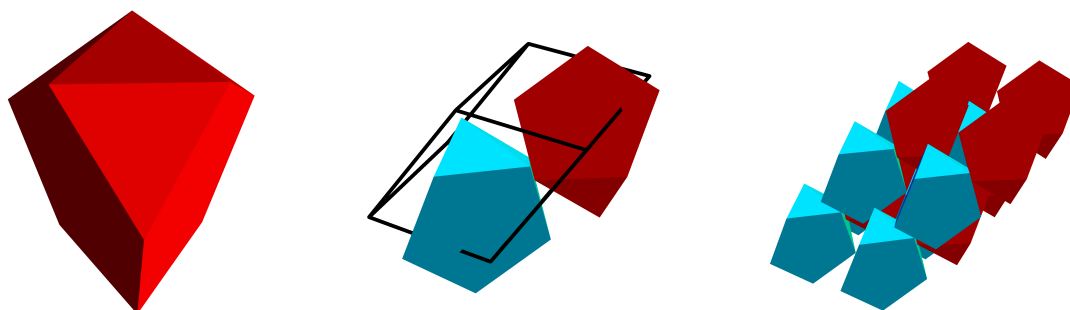
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.86679
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.029950, 0.000000, 0.000000\}$ $\mathbf{v2} = \{-0.628987, -0.927295, 0.000000\}$ $\mathbf{v3} = \{-0.077060, -0.137008, -1.225770\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.159454	-0.472185	-0.212137	$\begin{pmatrix} 0.230624 & 0.971659 & -0.051869 \\ 0.836885 & -0.225266 & -0.498878 \\ -0.496423 & 0.071645 & -0.865119 \\ -0.016609 & -0.952423 & 0.304328 \\ -0.646732 & 0.242358 & 0.723188 \\ -0.762537 & -0.184807 & -0.619987 \end{pmatrix}$
2	1.096820	-0.598203	-0.941883	

# JS90: Tridiminished Icosahedron



## Model Parameters

Model file: Tridiminished\_Icosahedron.ply  
 Sphericity: 0.50209  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.26245  
 Oriented-bounding-box lower bound to the MPF: 0.37267

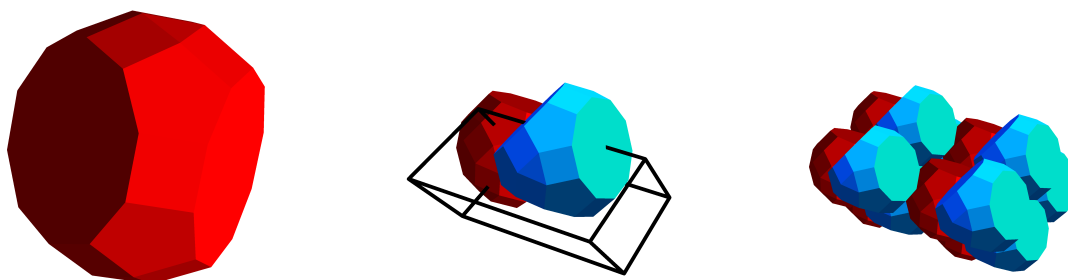
## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.91669  
 Particles form a centrosymmetric compound (y/n/-): -  
 Lattice Vectors:  $\mathbf{v1} = \{1.404820, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-0.005934, -1.492070, -0.000000\}$   
 $\mathbf{v3} = \{-0.608433, -0.745715, -1.040870\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.330411	-1.786070	-0.785119	$\begin{pmatrix} 0.088486 & 0.732696 & -0.674779 \\ -0.956716 & 0.251072 & 0.147165 \\ 0.277245 & 0.632549 & 0.723199 \end{pmatrix}$
2	1.070270	-0.670301	-0.473908	$\begin{pmatrix} -0.784297 & 0.583783 & -0.209941 \\ 0.554989 & 0.508998 & -0.657958 \\ -0.277245 & -0.632549 & -0.723199 \end{pmatrix}$

# JS91: Tridiminished Rhombicosidodecahedron



## Model Parameters

Model file:	Tridiminished_Rhombicosidodecahedron.ply
Sphericity:	0.73251
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.55005
Oriented-bounding-box lower bound to the MPF:	0.52883

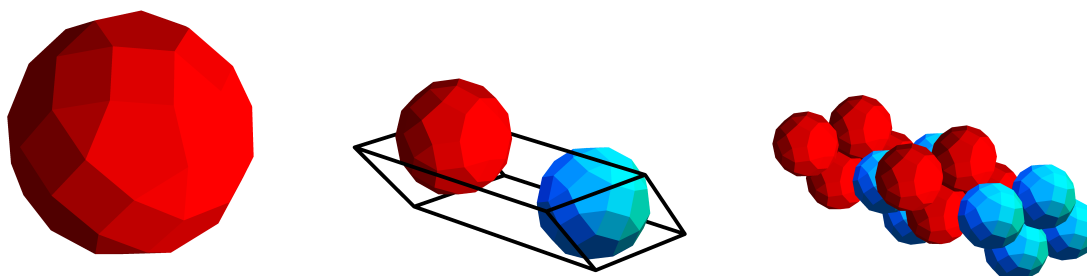
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.84993
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{1.813420, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.057774, -1.302380, 0.000000\}$ $\mathbf{v3} = \{-0.015104, -0.794844, 0.996340\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.968753	-0.808514	0.804765	$\begin{pmatrix} -0.786933 & -0.083969 & 0.611298 \\ 0.225781 & 0.882807 & 0.411915 \\ -0.574246 & 0.462169 & -0.675752 \end{pmatrix}$
2	0.054150	-0.149882	0.160098	$\begin{pmatrix} 0.108456 & 0.528326 & 0.842086 \\ -0.636165 & -0.614033 & 0.467179 \\ 0.763892 & -0.586374 & 0.269507 \end{pmatrix}$

# JS92: Trigurate Rhombicosidodecahedron



## Model Parameters

Model file:	Trigurate_Rhombicosidodecahedron.ply
Sphericity:	0.92459
Centrosymmetric (C/NC):	NC
Upper bound to the maximum packing fraction (MPF):	0.83596
Outscribed-sphere lower bound to the MPF:	0.66075
Oriented-bounding-box lower bound to the MPF:	0.54302

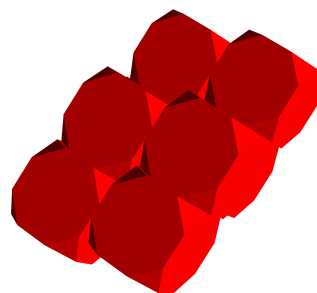
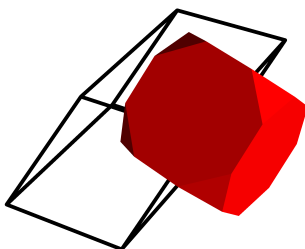
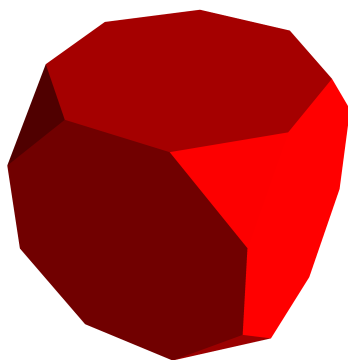
## Unit Cell Parameters

Number of particles:	2
Maximum packing fraction (MPF):	0.80456
Particles form a centrosymmetric compound (y/n/-):	-
Lattice Vectors:	$\mathbf{v1} = \{2.317600, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.612698, -1.022130, 0.000000\}$ $\mathbf{v3} = \{0.322396, 0.537743, -1.049360\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.645030	0.228715	-0.769151	$\begin{pmatrix} 0.465337 & -0.801693 & 0.375166 \\ 0.461155 & 0.581368 & 0.670333 \\ -0.755511 & -0.138921 & 0.640237 \\ -0.343554 & 0.239550 & -0.908067 \\ -0.709892 & 0.566787 & 0.418097 \\ 0.614836 & 0.788269 & -0.024667 \end{pmatrix}$
2	0.179707	-0.282710	-0.057387	

# AS12: Truncated Cube



## Model Parameters

Model file:	Truncated.Cube.ply
Sphericity:	0.67859
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	1.00000
Outscribed-sphere lower bound to the MPF:	0.42712
Oriented-bounding-box lower bound to the MPF:	0.96649

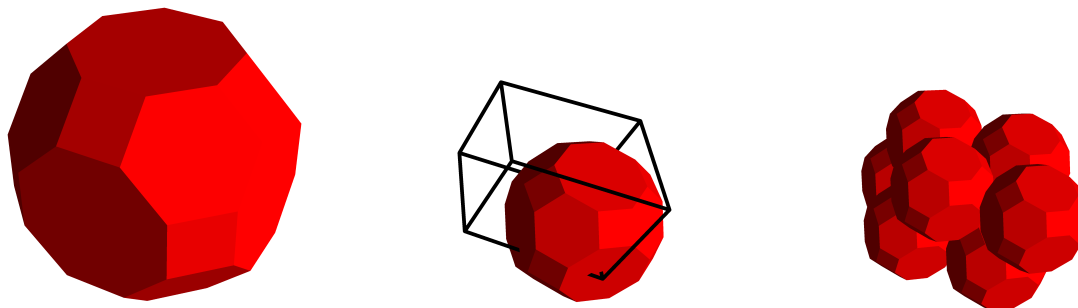
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.97374
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.043360, 0.000000, -0.000000\}$ $\mathbf{v2} = \{-0.028168, -1.522800, 0.000000\}$ $\mathbf{v3} = \{0.248336, 0.743713, 0.647385\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.197350	-0.400433	0.477255	$\begin{pmatrix} -0.000000 & -0.732773 & 0.680473 \\ -0.969389 & 0.167077 & 0.179918 \\ -0.245531 & -0.659643 & -0.710342 \end{pmatrix}$

# AS07: Truncated Cuboctahedron



## Model Parameters

Model file: Truncated\_Cuboctahedron.ply  
 Sphericity: 0.82594  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.59356  
 Oriented-bounding-box lower bound to the MPF: 0.74491

## Unit Cell Parameters

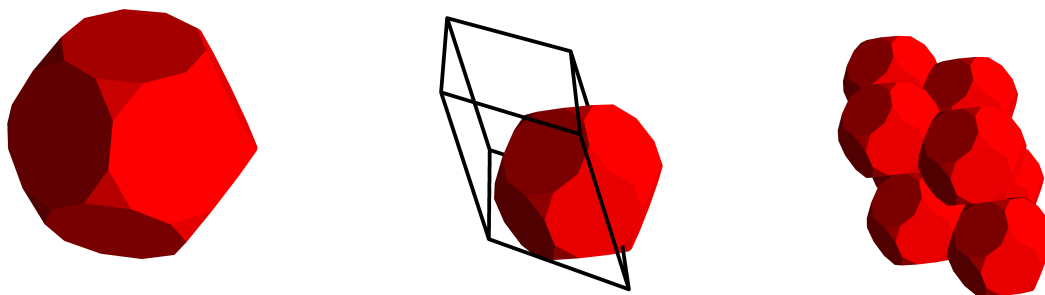
Number of particles: 1  
 Maximum packing fraction (MPF): 0.84937  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.264760, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{0.664090, -0.960163, 0.000000\}$   
 $\mathbf{v3} = \{0.563504, -0.152986, 0.969949\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.516810	-0.493609	0.107765	$\begin{pmatrix} -0.656476 & -0.738224 & 0.155128 \\ 0.691003 & -0.670985 & -0.268876 \\ 0.302579 & -0.069317 & 0.950600 \end{pmatrix}$



# AS10: Truncated Dodecahedron



## Model Parameters

Model file:	Truncated_Dodecahedron.ply
Sphericity:	0.83850
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.97387
Outscribed-sphere lower bound to the MPF:	0.57413
Oriented-bounding-box lower bound to the MPF:	0.50032

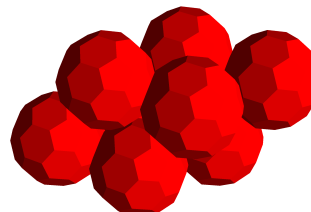
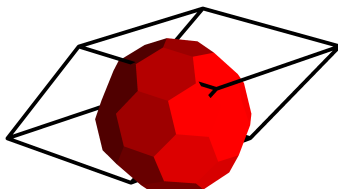
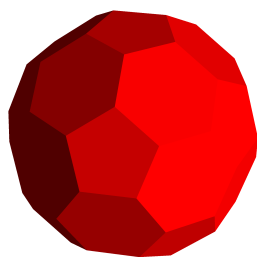
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.89778
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.162020, 0.000000, -0.000000\}$ $\mathbf{v2} = \{0.583743, -1.009570, 0.000000\}$ $\mathbf{v3} = \{0.583682, -0.334334, -0.949563\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.550400	-0.599301	-0.768093	$\begin{pmatrix} -0.072712 & -0.865622 & 0.495391 \\ -0.921813 & -0.131296 & -0.364721 \\ 0.380754 & -0.483177 & -0.788395 \end{pmatrix}$

# AS02: Truncated Icosahedron



## Model Parameters

Model file:	Truncated_Icosahedron.ply
Sphericity:	0.91495
Centrosymmetric (C/NC):	C
Upper bound to the maximum packing fraction (MPF):	0.83856
Outscribed-sphere lower bound to the MPF:	0.64230
Oriented-bounding-box lower bound to the MPF:	0.51351

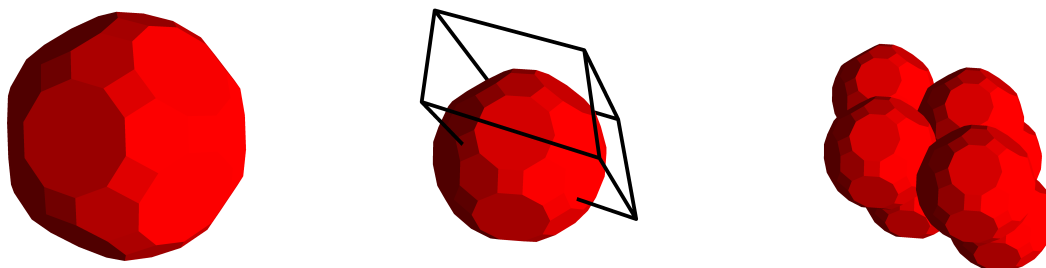
## Unit Cell Parameters

Number of particles:	1
Maximum packing fraction (MPF):	0.78498
Particles form a centrosymmetric compound (y/n/-):	y
Lattice Vectors:	$\mathbf{v1} = \{1.251410, -0.000000, 0.000000\}$ $\mathbf{v2} = \{0.623917, 1.019570, -0.000000\}$ $\mathbf{v3} = \{-0.623648, -0.271566, -0.998520\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.802213	0.152591	-0.527353	$\begin{pmatrix} 0.271502 & 0.625807 & 0.731199 \\ -0.833270 & 0.533022 & -0.146792 \\ -0.481609 & -0.569432 & 0.666183 \end{pmatrix}$

# AS06: Truncated Icosidodecahedron



## Model Parameters

Model file: Truncated\_Icosidodecahedron.ply  
 Sphericity: 0.90494  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 0.89731  
 Outscribed-sphere lower bound to the MPF: 0.66498  
 Oriented-bounding-box lower bound to the MPF: 0.53395

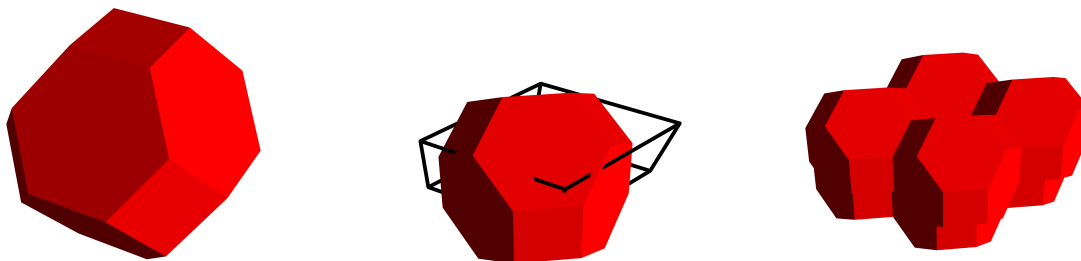
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 0.82721  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.190970, 0.000000, 0.000000\}$   
 $\mathbf{v2} = \{-0.593607, 1.036600, 0.000000\}$   
 $\mathbf{v3} = \{0.000178, -0.694726, 0.979505\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	0.174209	0.203764	0.038778	$\begin{pmatrix} 0.796260 & 0.214306 & 0.565724 \\ -0.570250 & 0.578080 & 0.583643 \\ -0.201956 & -0.787335 & 0.582510 \end{pmatrix}$

# AS13: Truncated Octahedron



## Model Parameters

Model file: Truncated.Octahedron.ply  
 Sphericity: 0.77459  
 Centrosymmetric (C/NC): C  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.50596  
 Oriented-bounding-box lower bound to the MPF: 0.53333

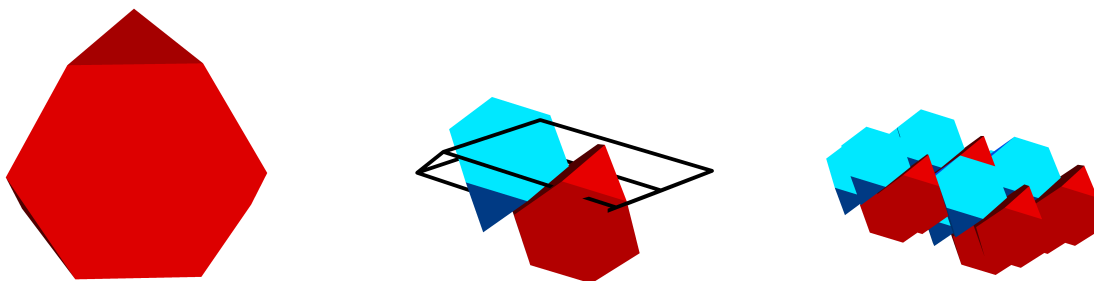
## Unit Cell Parameters

Number of particles: 1  
 Maximum packing fraction (MPF): 1.00000  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  $\mathbf{v1} = \{1.091120, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.363708, 1.028720, -0.000000\}$   
 $\mathbf{v3} = \{0.363708, -0.514361, 0.890899\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.024720	-0.097462	0.556834	$\begin{pmatrix} 0.000311 & -0.000161 & -1.000000 \\ 0.816496 & 0.577350 & 0.000161 \\ 0.577350 & -0.816496 & 0.000311 \end{pmatrix}$

# AS01: Truncated Tetrahedron



## Model Parameters

Model file: Truncated.Tetrahedron.ply  
 Sphericity: 0.52223  
 Centrosymmetric (C/NC): NC  
 Upper bound to the maximum packing fraction (MPF): 1.00000  
 Outscribed-sphere lower bound to the MPF: 0.29718  
 Oriented-bounding-box lower bound to the MPF: 0.41071

## Unit Cell Parameters

Number of particles: 2  
 Maximum packing fraction (MPF): 0.99519  
 Particles form a centrosymmetric compound (y/n/-): y  
 Lattice Vectors:  
 $\mathbf{v1} = \{2.146820, -0.000000, -0.000000\}$   
 $\mathbf{v2} = \{0.637817, 1.092480, -0.000000\}$   
 $\mathbf{v3} = \{0.765069, -0.497461, 0.863955\}$

## Particles in unit cell:

Index	$x$	$y$	$z$	Rotation Matrix
1	1.131550	0.151934	0.361579	$\begin{pmatrix} -0.262282 & -0.099563 & -0.959841 \\ 0.891959 & 0.354573 & -0.280512 \\ 0.368262 & -0.929713 & -0.004192 \end{pmatrix}$
2	2.317070	-0.123891	0.365262	$\begin{pmatrix} 0.262282 & 0.099563 & 0.959841 \\ 0.891959 & 0.354573 & -0.280512 \\ -0.368262 & 0.929713 & 0.004192 \end{pmatrix}$

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