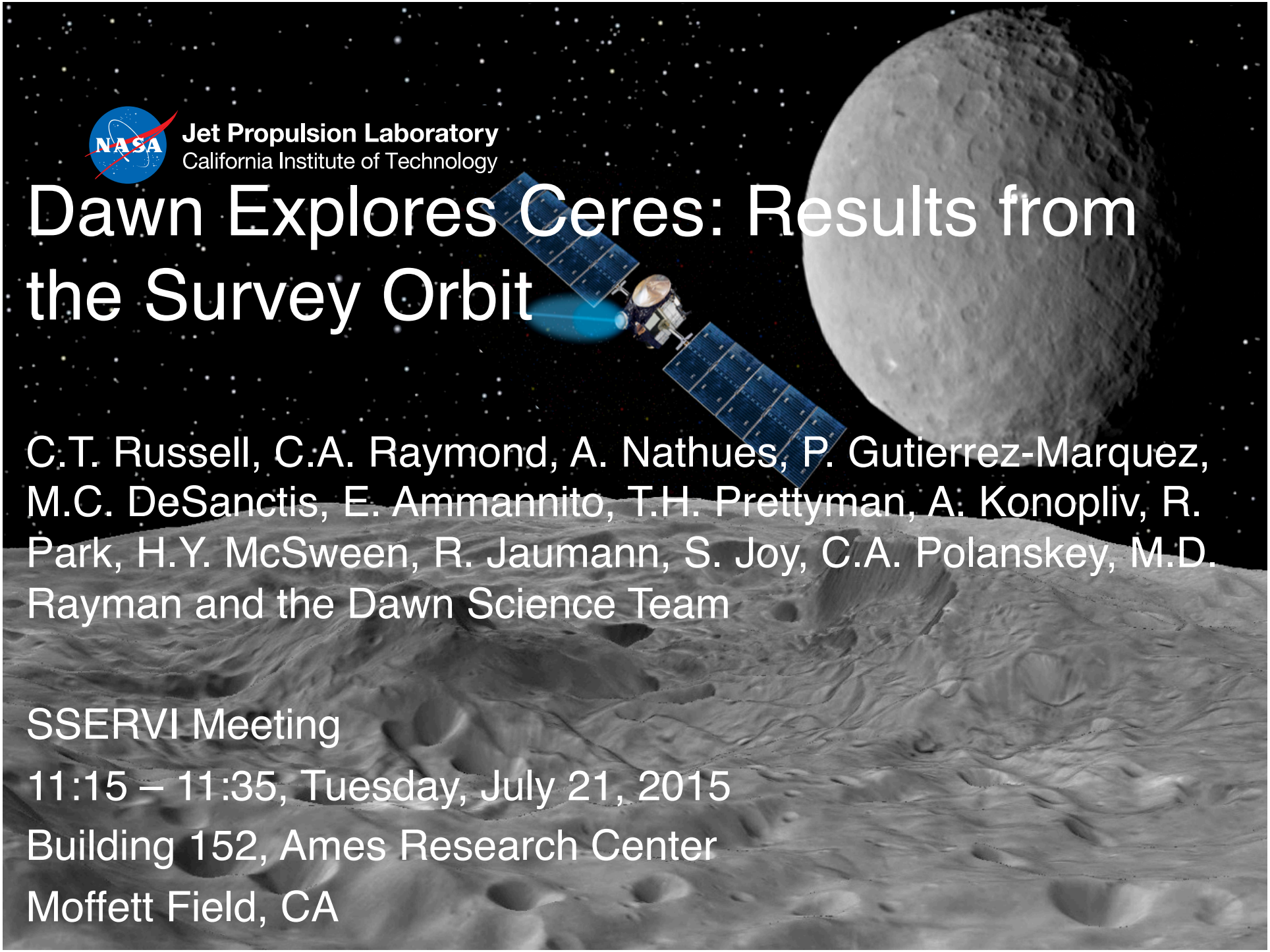


Jet Propulsion Laboratory
California Institute of Technology

Dawn Explores Ceres: Results from the Survey Orbit

C.T. Russell, C.A. Raymond, A. Nathues, P. Gutierrez-Marquez, M.C. DeSanctis, E. Ammannito, T.H. Prettyman, A. Konopliv, R. Park, H.Y. McSween, R. Jaumann, S. Joy, C.A. Polanskey, M.D. Rayman and the Dawn Science Team

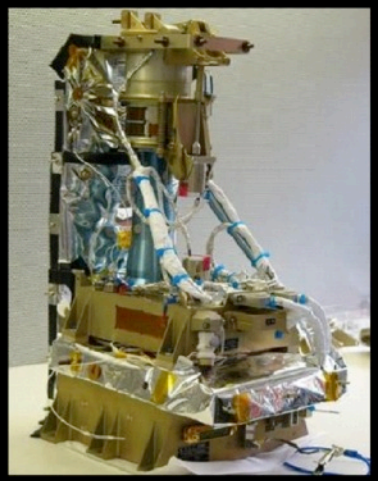
SSERVI Meeting

11:15 – 11:35, Tuesday, July 21, 2015

Building 152, Ames Research Center

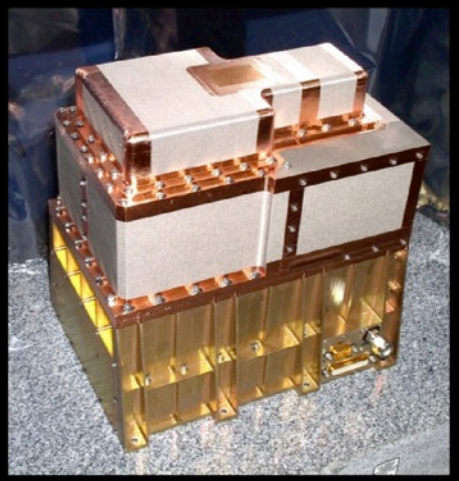
Moffett Field, CA

Dawn Instruments



Framing Camera

Provided and operated by the German Aerospace Agency (DLR) and the Max Planck Institute for Solar System Research (MPS)



Gamma Ray and Neutron Detector

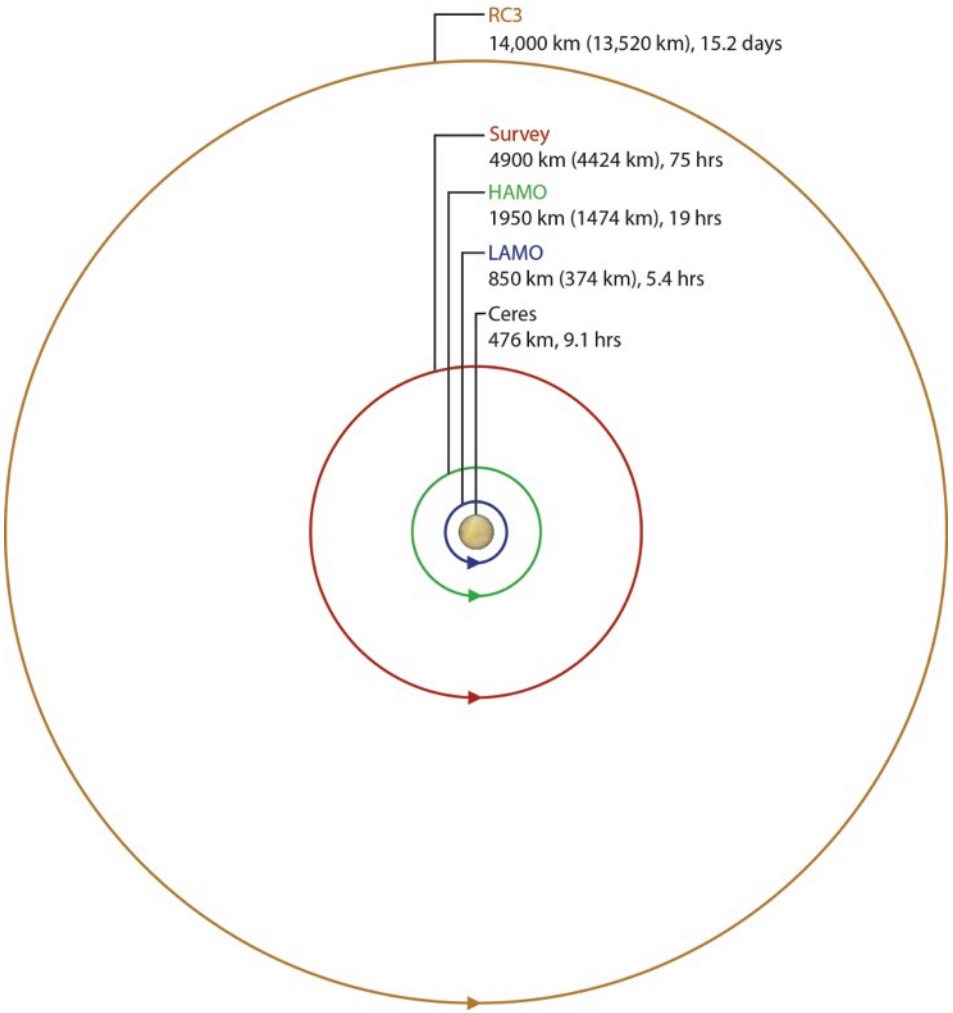
Provided by Los Alamos National Labs (LANL) and operated by the Planetary Science Institute (PSI)

Visible and Infrared Mapping Spectrometer

Provided by the Italian Space Agency (ASI) and the Italian National Institute for Astrophysics, and operated by the Italian Institute for Space Astrophysics and Planetology

- Dawn also obtains gravity data from radiometric tracking.

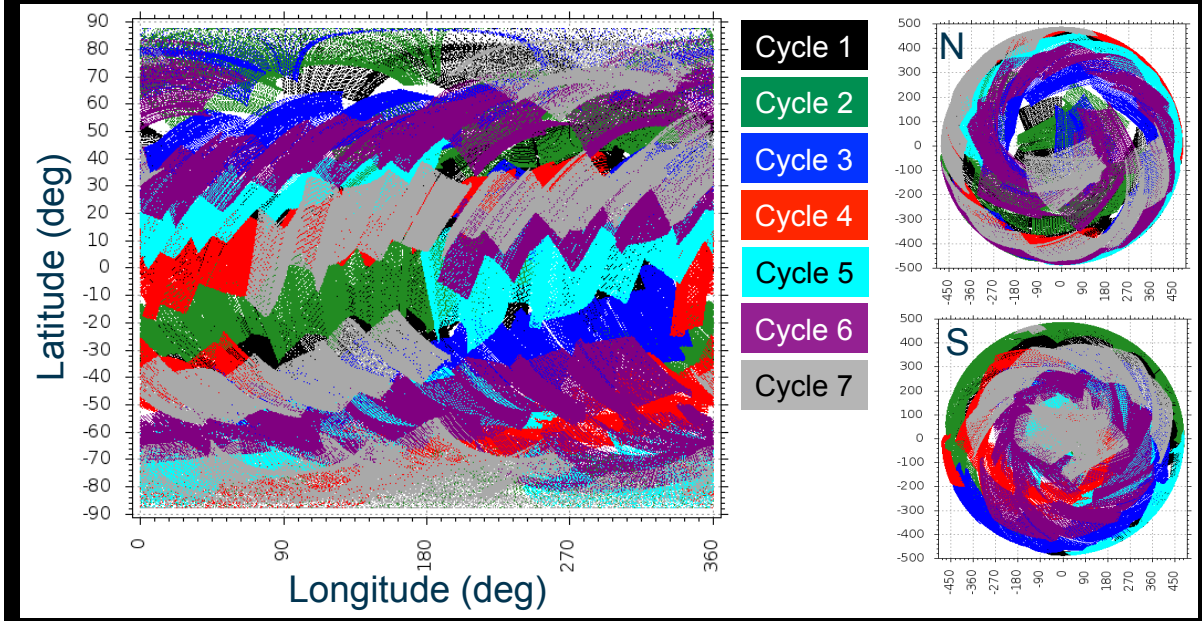
Ceres Orbit Plan: RC3, Survey, HAMO, LAMO



- The planned orbits follow the scheme used at Vesta with some extra emphasis on RC3.
- Survey optimized for VIR.
- HAMO optimized for stereo photogrammetry.
- LAMO optimized for GRaND and gravity.
- Have completed RC3 and Survey.

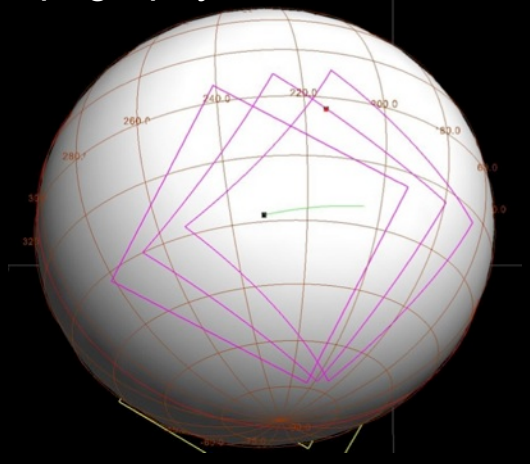
Survey

Achieves near-global mineralogical mapping (7b)

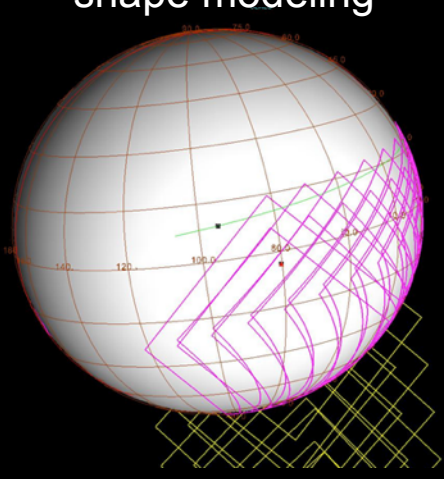


- Improves Ceres gravity knowledge for navigation
- Seven 1-orbit cycles
- 22 day phase duration

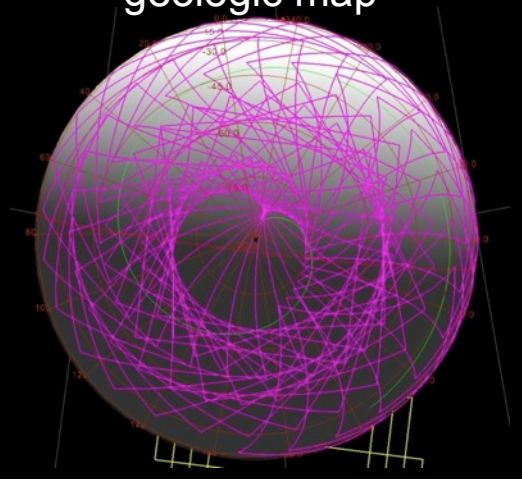
Large camera FOV provides topography from nadir attitude



Limb imaging supports shape modeling



Global color imaging coverage provides coarse geologic map

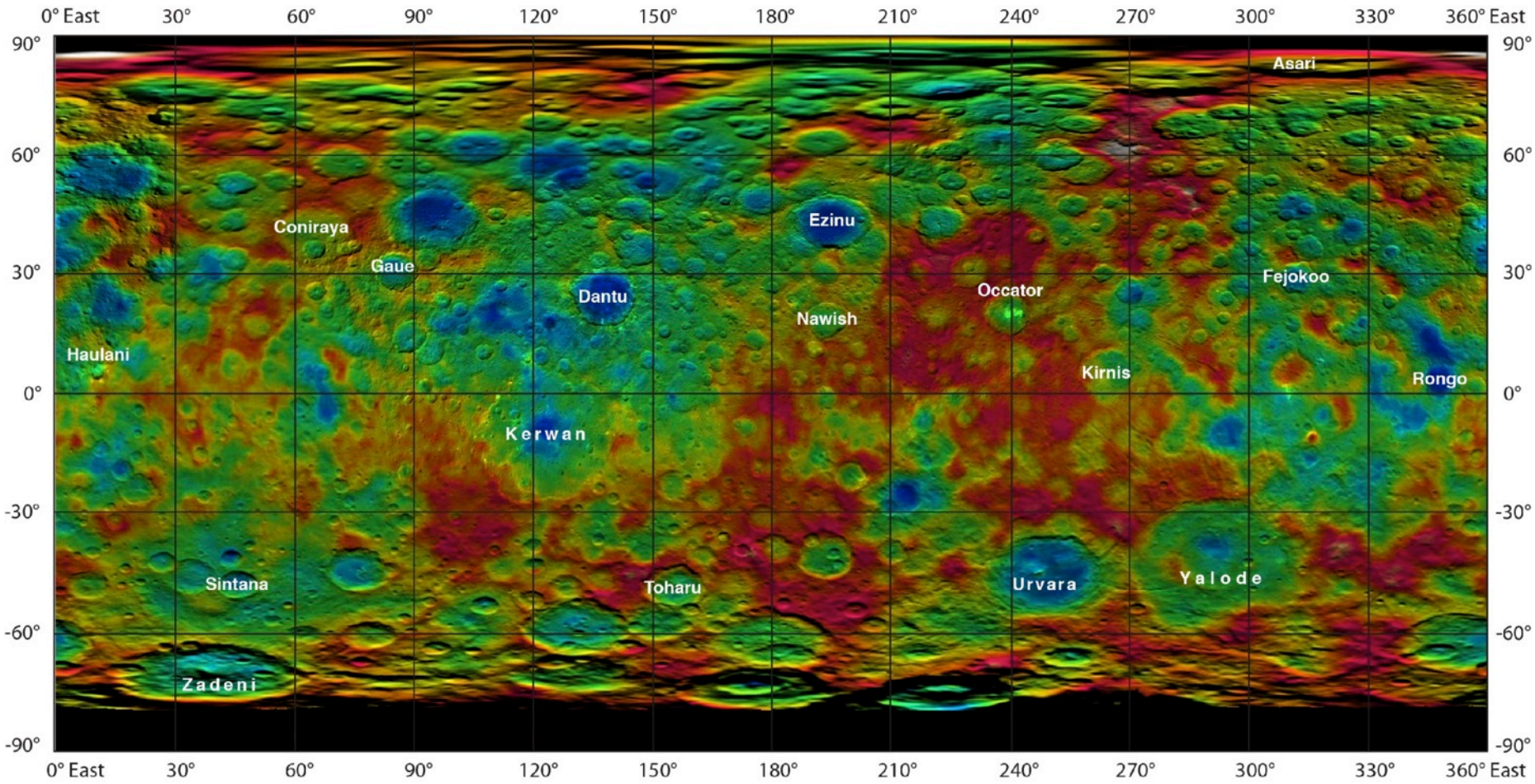


Physical Properties

	Now	Before (Thomas et al., 2005)
Pole Position RA DEC	29.41° 66.79°	291° 59°
W_0	170.9°	170.9°
Spin period	952.1532 deg/day	952.07 deg/day
Obliquity	~3°	~3°
Mass	(9.393 ± .005) x 10^{20}kg	(9.395 ± 0.125) x 10^{20} kg
Dimensions	482.6 ± 1.0 by 480.6 ± 1.0 by 445.6 ± 1.0 km	487 ± 2 by 487 ± 2 by 455 ± 2 km
Density	2,160^{+} kg m^{-3}	2,077 kg m^{-3}

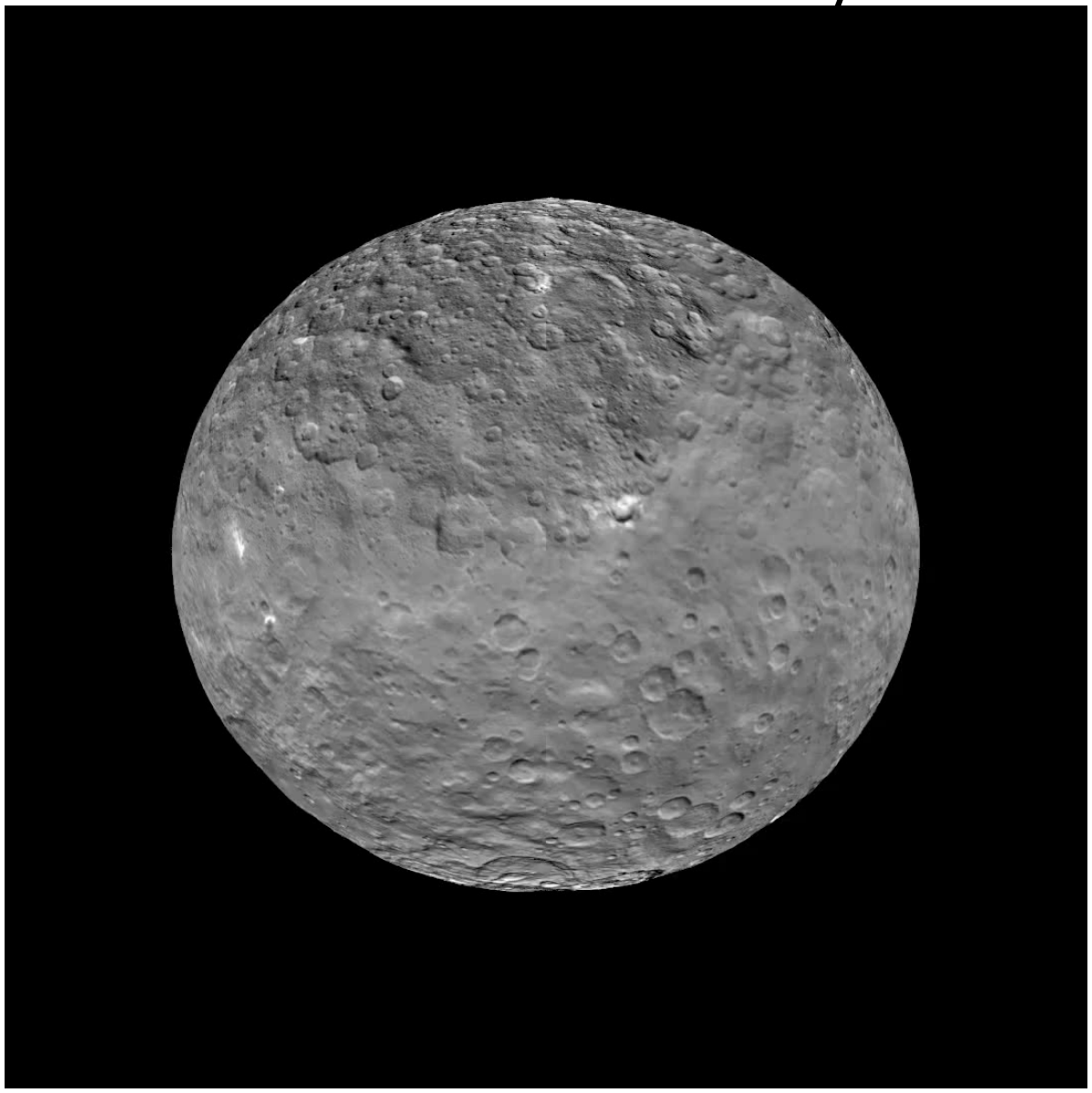
$^{+}$ 4% above Thomas et al (2005)

Ceres RC3 Mosaic-DTM with Proposed Crater Names



Harvest Deities

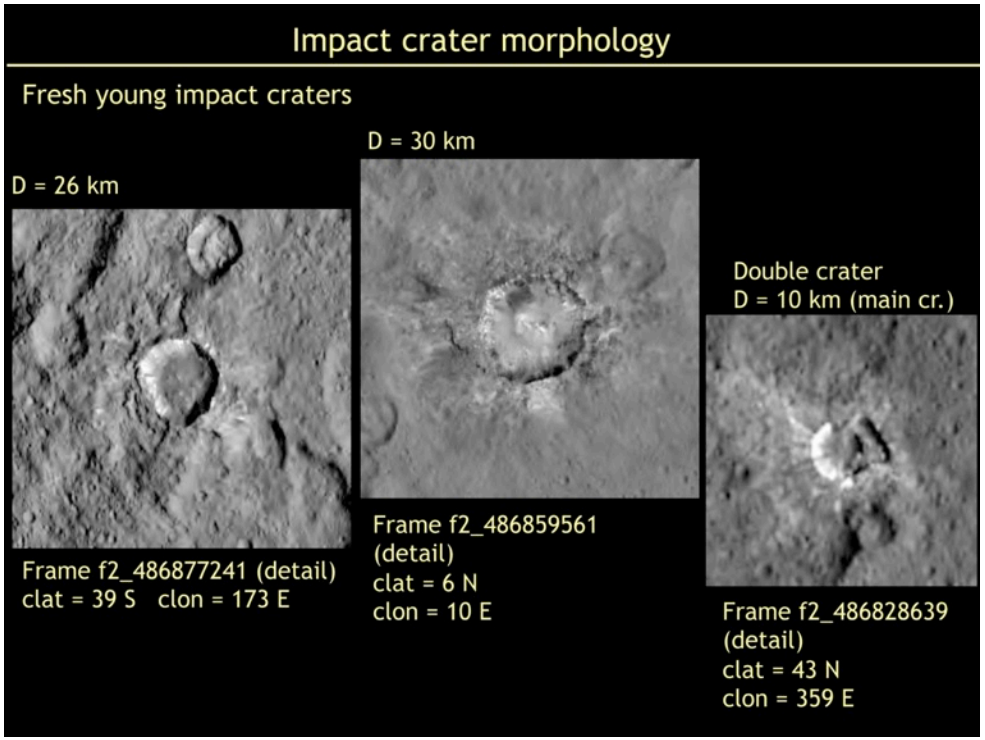
Ceres Clear Filter Survey

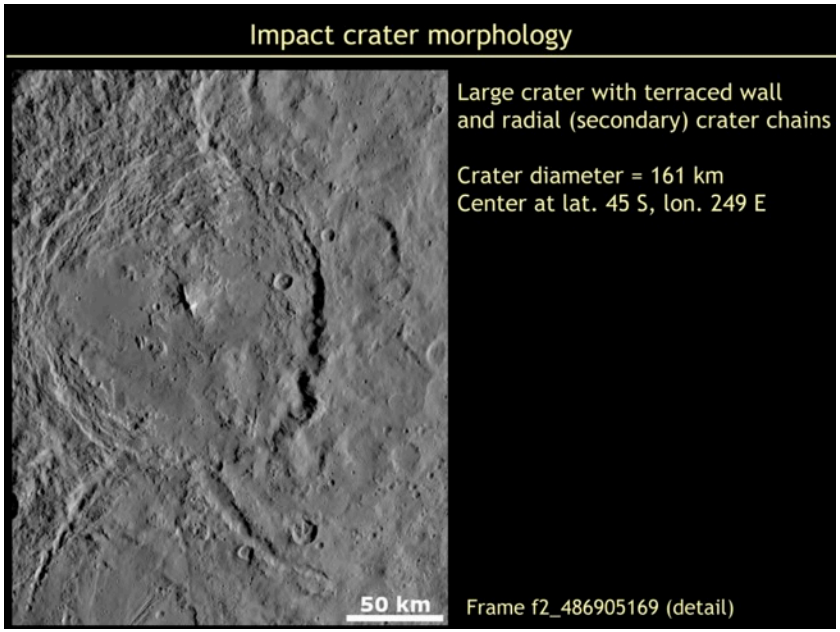


Movie

Credit: D. O'Brien and MPS Camera team
A. Nathues, lead.

Crater Definition: A Circular Depression

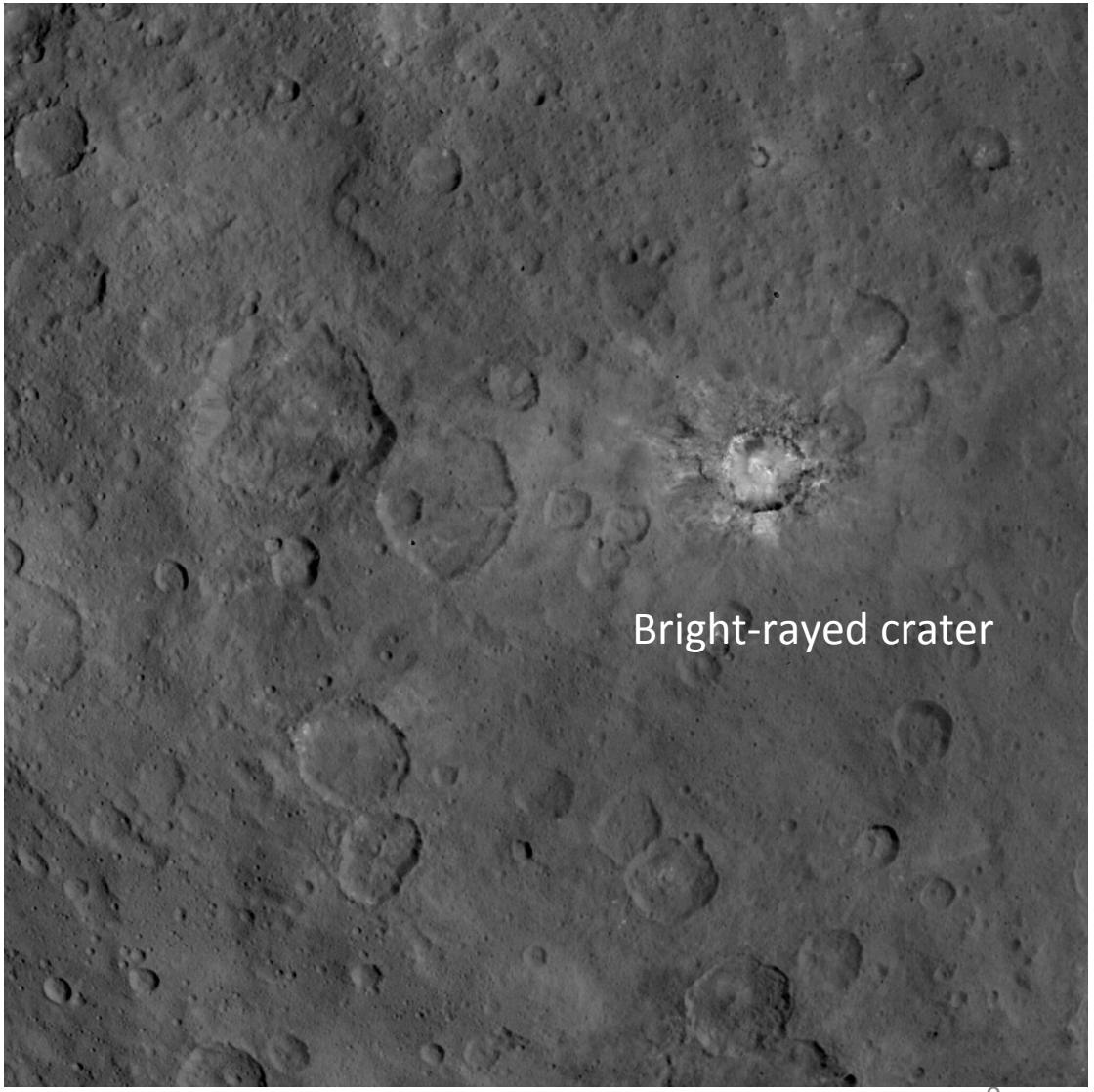




- Ceres has a heavily cratered surface, but these craters differ significantly from Vesta.
- Distribution of sizes is different.
- Three main classes: simple crater, crater with central peak, crater with central pit.

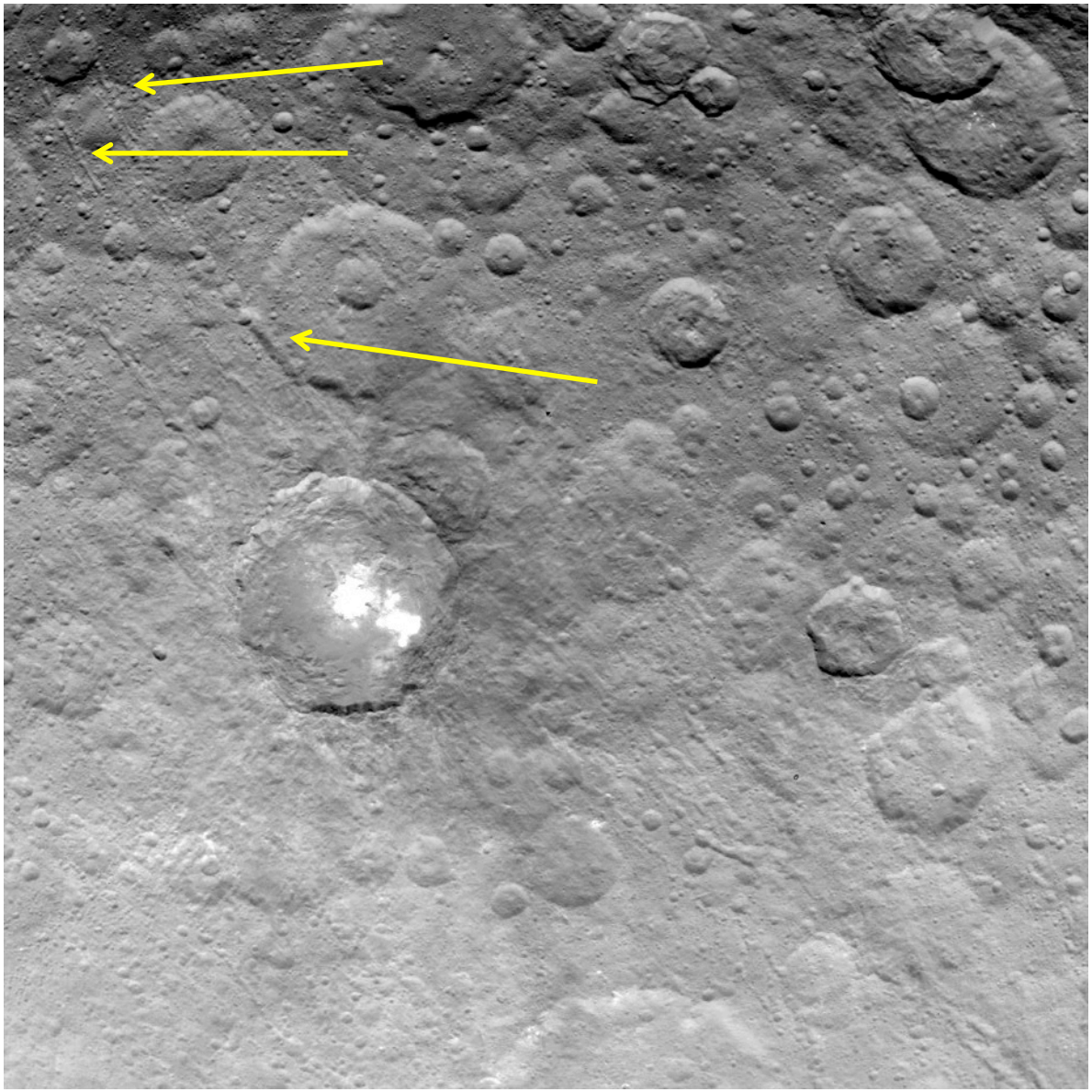
Not All Are Circular

- Craters on Ceres are not necessarily circular.
  There are many hexagonal craters; many irregular craters; many degraded craters.
- There are craters with filled interiors, including hills and mounds.
- There are craters with bright spots.
- There are bright rayed craters.



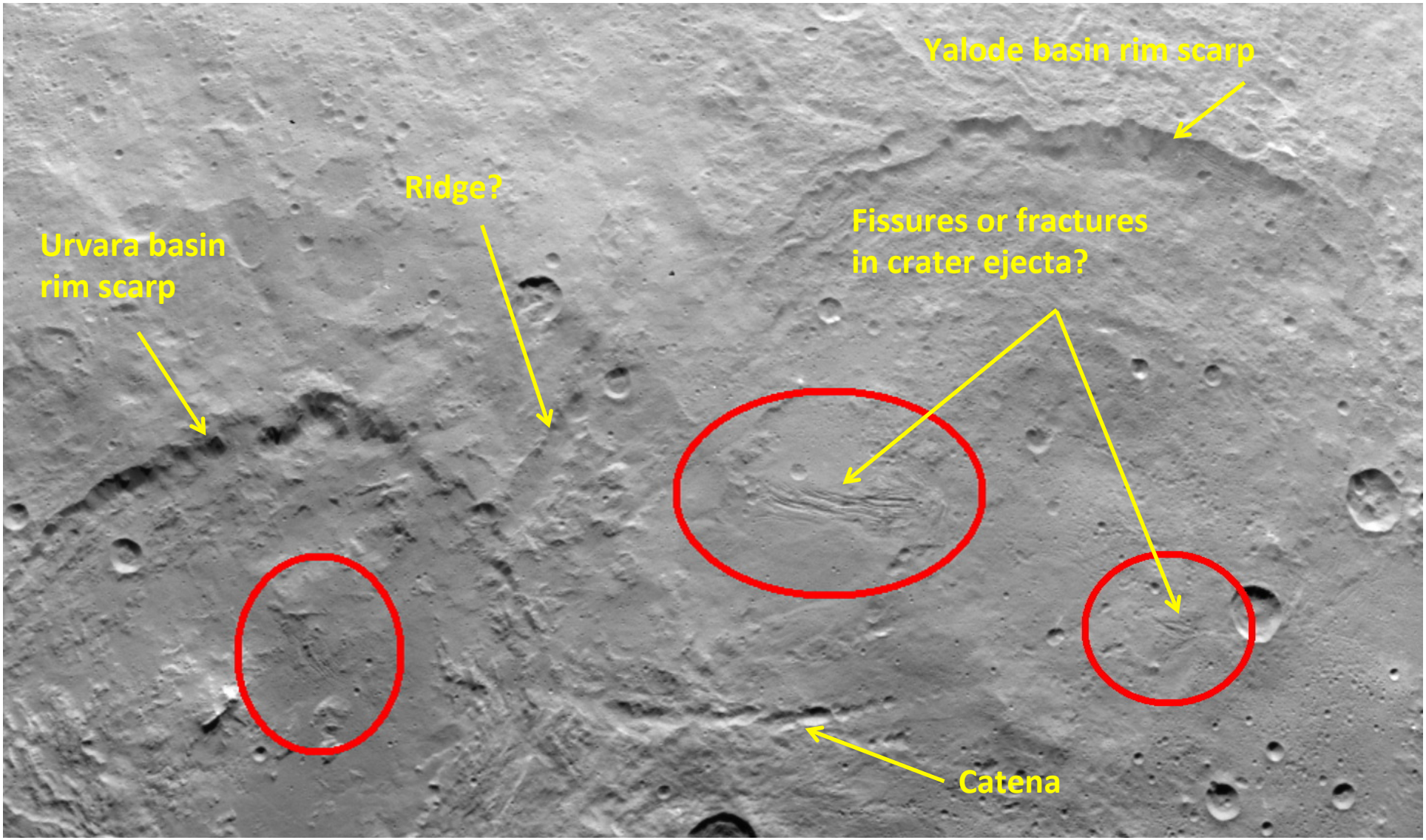
Catena (Catenae): Chain of Craters

- Catenae are usually connected chains of impact craters, but could also be used for pit crater chains
- Pit crater chains can be formed along fractures.
- This photo shows chains near the famous bright spot crater.



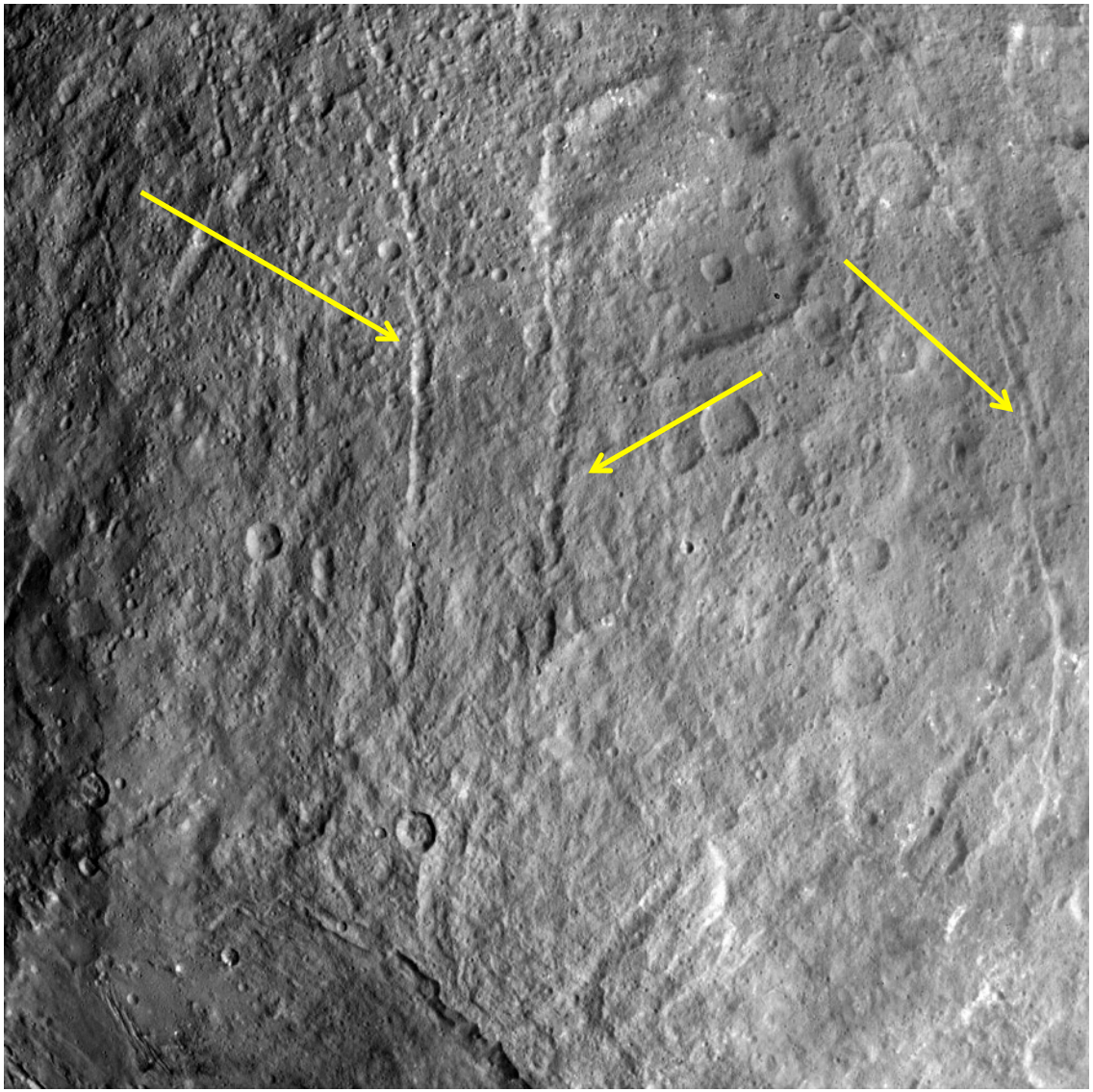
Dorsum (Dorsa): Ridge

- Ridges are often crater edges, but possibly not all ridges are crater walls.



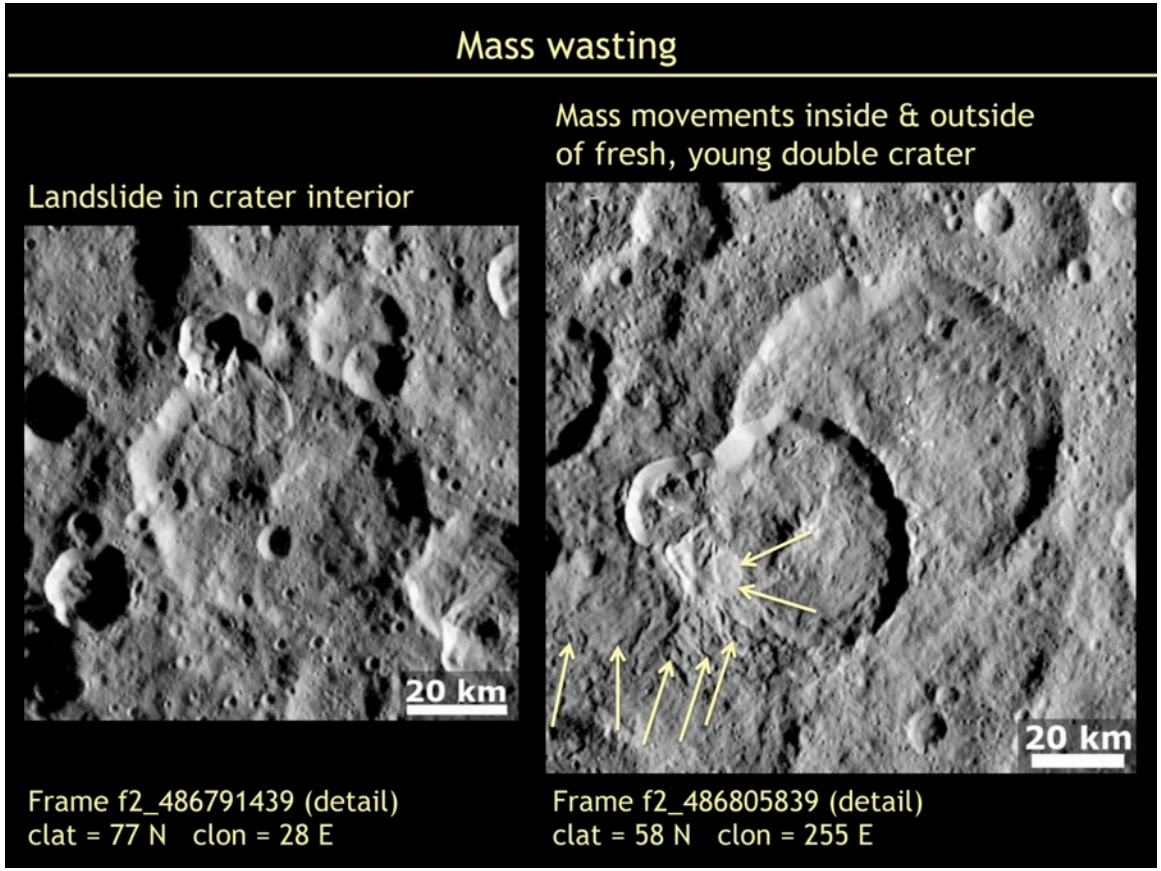
Fossa (Fossae): Long, Narrow Depression

- These linear features noted on approach.
- Geologic process that formed these features unclear.



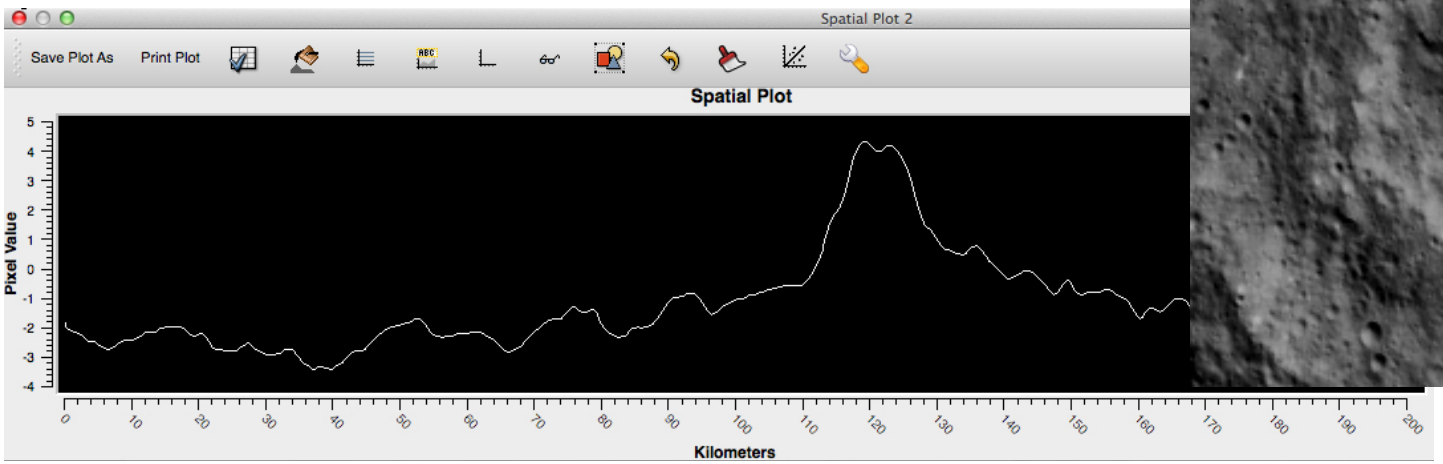
Labes (Labes): Landslide

- Flow-like features at base of topographic highs.
- Assumed to be mass wasting features.



Mons (Montes): Mountain

- "The Pyramid", also seen on Approach
- It is about 5 km high, 30 km wide, knobby flat top w/bright downslope streaks.
- Currently this structure is unique and extremely intriguing.

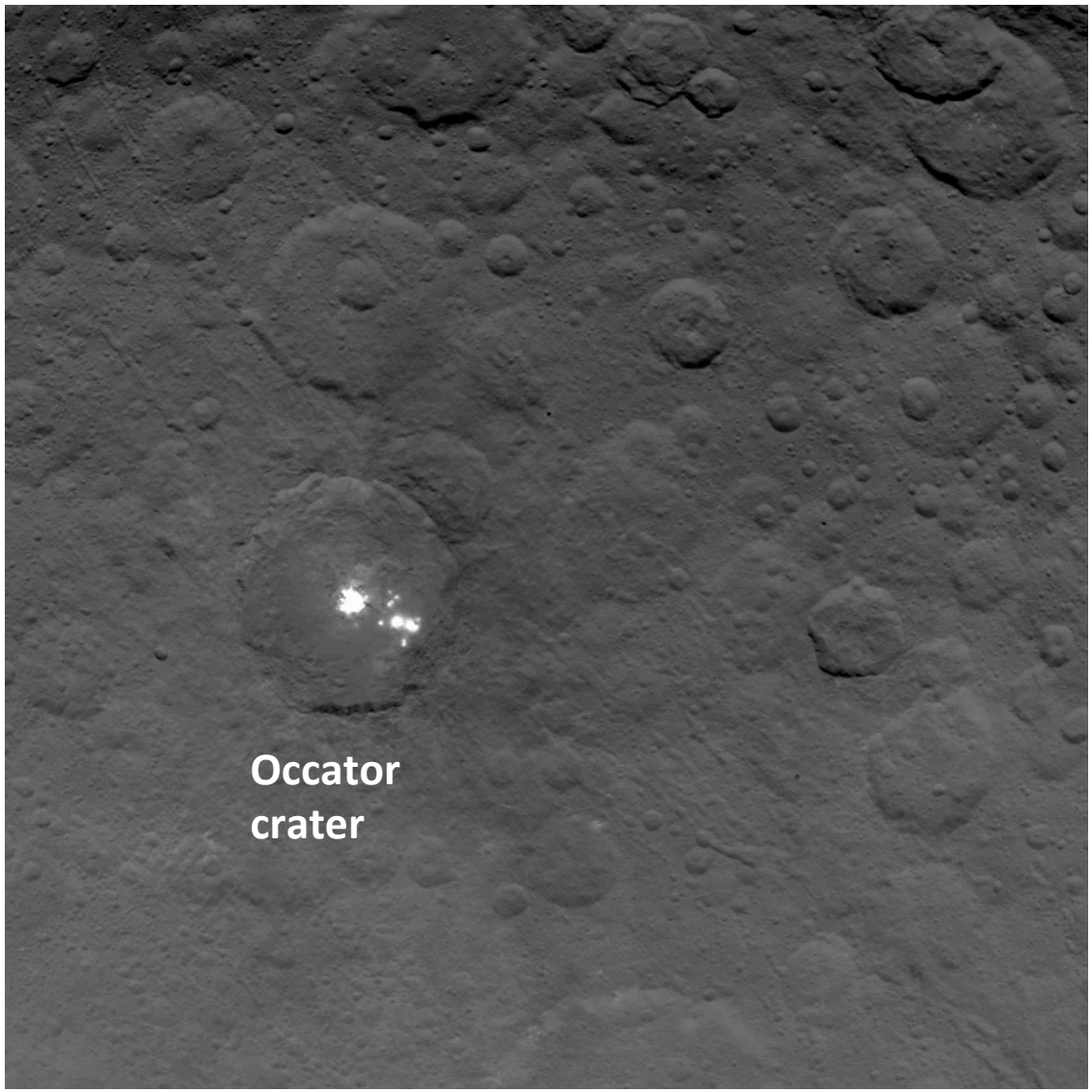


Pyramid: The Movie

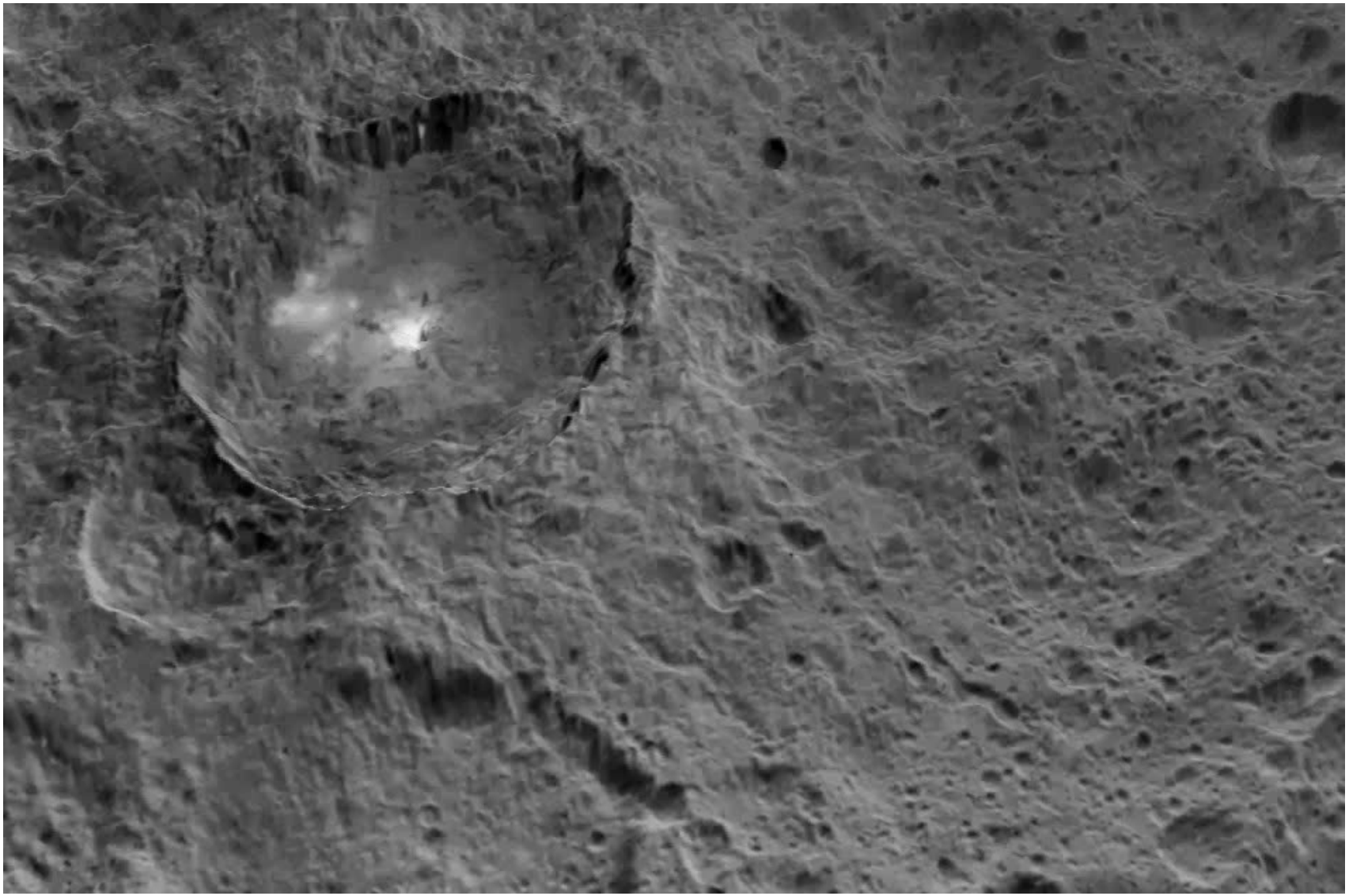
Credit: Paul Schenk and the MPS Camera team, A. Nathues, lead.

Facula (Faculae): Bright Spots

- The bright spots have an unusual distribution. They do not seem to be crated by an impact. They come in different sizes.
- How old are they? Could they be transient? Are they ice? Salt? Other?
- There are other bright spots, but none as complex as this grouping.



Occator Crater: Home of the Bright Spots



Movie

Credit: Paul Schenk and MPS Camera Team: A Nathues, lead.

Summary

- Ceres is our prototype wet protoplanet, intact from the earliest days of the solar system.
- It is the most massive body in the asteroid belt.
- It is unlike any other solar system body.
- Whatever the cause of the bright spots, they indicate that Ceres is active today.
- Despite it being unique, it is important to the inhabitants of Earth as it tells us how we may have obtained our ample water supply on Earth.
- Ceres may also harbor life and could be more conducive to life than bodies in the outer solar system.