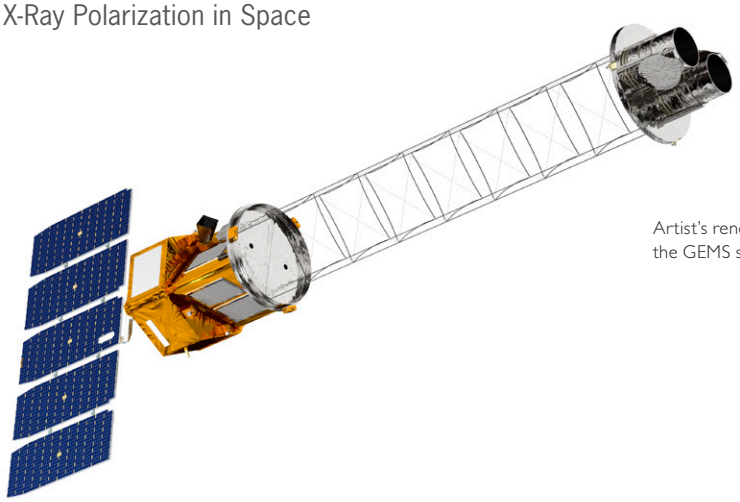
Orbital
Innovation You Can Count On®

FACT SHEET

Gravity and Extreme Magnetism SMEX (GEMS)

Measuring X-Ray Polarization in Space



Artist's rendering of the GEMS satellite

Mission Description

Orbital is designing, manufacturing, integrating and testing the Gravity and Extreme Magnetism (GEMS) satellite to study X-ray polarization in space. Under a NASA contract, Orbital will provide the spacecraft bus and conduct mission operations for the Goddard Space Flight Center (GSFC). The GEMS mission is being led by the project's Principal Investigator Dr. Jean Swank.

The GEMS satellite will be the first observatory to systematically measure X-ray polarization which encodes information about the structure of cosmic sources, unlocking a previously hidden astrophysical world. Previous space-based X-ray observatories have been insensitive to polarization, which refers to the direction of the electric field of electromagnetic waves. Polarization measurements will allow scientists to study scattering, magnetic fields and strong gravitational fields.

The purpose of the GEMS mission is to help scientists answer fundamental questions about the universe, such as:

- Where is energy released near black holes?
- What is the origin of X-ray emissions from pulsars?
- What is the magnetic field structure in high energy nebulae?

Spacecraft

The GEMS satellite is based on Orbital's proven LEOStar™-2 spacecraft bus design. GEMS will be the eighth satellite to be based on the LEOStar-2 platform. Other LEOStar-based satellites that Orbital has built or currently has in development for NASA include the in-orbit SORCE, GALEX, and AIM spacecraft; and the NuSTAR spacecraft scheduled for launch in 2013.

QUICK FACTS:

GEMS will be the first observatory to systematically measure X-ray polarization.

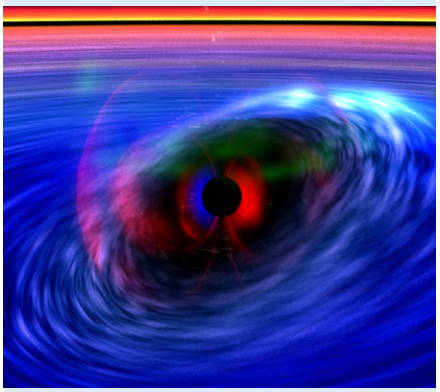
The observatory will have a 4-meter boom that will be deployed from the Observatory after launch.

Mission:

NASA Small Explorer (SMEX) Program

Customer:

NASA/Goddard Space Flight Center – Greenbelt, MD



Still image from a computer animation of hot iron gas riding a wave in space around a black hole. This animation depicts how extreme gravity can cause light to stretch and how a spinning black hole can drag the very fabric of space around with it. *Credit: NASA*

GEMS

Specifications

Spacecraft

Launch Mass:	288 kg
Solar Arrays:	684 W, Articulated
Stabilization:	3-axis
Orbit:	575 km, 28.5° inclination
Mission Life:	10 months
Power:	300 W (orbit average)

Instruments

X-Ray Polarimeter Instrument (XPI):
- Two 32 cm X-ray Grazing Incidence Mirrors
- Two Time Projection Chamber Polarimeters
- One 4.0 Meter Telescope Optical Boom

Bragg Reflection Polarimeter:
- Student Experiment
- Included in one of the telescopes

Launch

Launch Vehicle:	TBD
Launch Site:	Kennedy Space Center
Date:	November 2014

Key Mission Partners

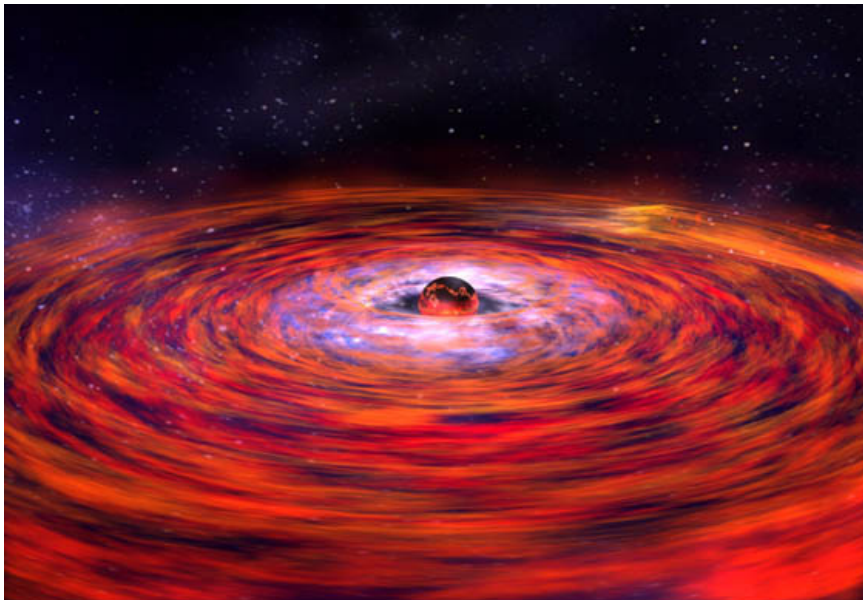
Orbital Sciences Corporation
Spacecraft design, integration & test, mission operations

NASA/GSFC
Project Management, X-ray polarimeter instrument, science operations center oversight, science data processing, systems engineering, education and public outreach

NASA's Ames Research Center
Data processing software, observatory management, education and public outreach

University of Iowa
Detector calibration and Bragg Reflection Polarimeter (BRP) instrument

ATK, Inc.
Telescope optical boom



Artist's depiction of x-ray-emitting matter trapped near a black hole. *Credit: NASA*

Polarized X-Rays

Among the thousands of X-ray sources observed with prior and current X-ray satellites, only one astrophysical object, the Crab Nebula, has been measured in polarized X-rays. By providing an increase in sensitivity of more than 100 times, the GEMS mission will detect and measure the polarization of the X-rays emitted by some of the most energetic and enigmatic objects in the cosmos. These include ultra-dense neutron stars and stellar-mass black holes, which are the remains of the dying explosions of very hot, massive stars, and ultra-massive black holes at the centers of distant galaxies. By studying the changes with time and energy of their polarized X-ray emission, the mission will probe the bending of space and the curving of light in regions of extreme gravity near these objects.

Orbital Innovation You Can Count On®