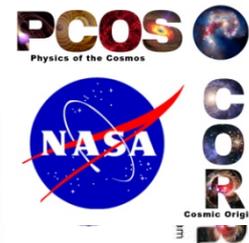


# Next Generation X-ray Optics: High-Resolution, Lightweight, and Low-Cost



PI: William W. Zhang/GSFC



## Objectives and Key Challenges:

- Develop a lightweight X-ray mirror technology achieving better than 5" HPD angular resolution, advancing it to TRL 5, and readying it to enable missions planned for both 2010's and 2020's
- Mature and perfect this technology to minimize cost and schedule
- Prepare ways to achieve significantly better than 5" resolution while keeping mass and cost at similar levels

## Significance of Work:

- Fabrication and metrology of mirror segments
- Alignment and bonding of mirror segments

## Approach:

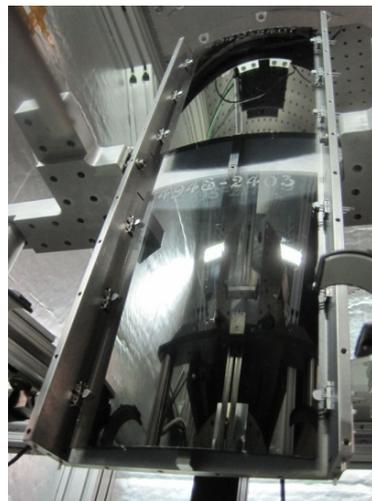
- Make mirror substrates by slumping glass or polishing silicon
- Maximize X-ray reflectance using magnetron sputter or atomic layer deposition
- Measure performance using interferometer, null lens, and interferometric microscope
- Align mirror segments using Hartmann tests
- Develop precision epoxy bonding techniques

## Key Collaborators:

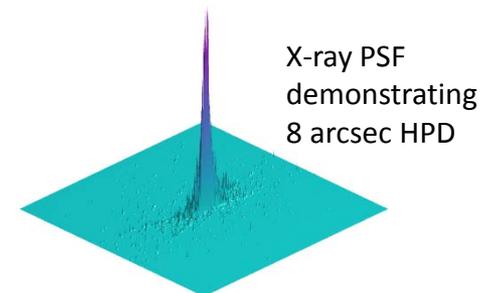
- Michael Biskach, Kai-Wing Chan, Ryan McClelland, Timo Saha (NASA/GSFC)
- Stephen O'Dell (NASA/MSFC)

## Current Funded Period of Performance:

- October 2014 – September 2016



A Technology Development Module (TDM) containing three pairs of parabolic-hyperbolic mirror segments that has passed both performance and environmental test



## Recent Accomplishments:

- ✓ Repeatedly co-aligned and bonded multiple mirror pairs, achieving 8" HPD X-ray Point Spread Function (PSF, see lego plot above)

## Next Milestones:

- Transition from using glass substrates to using single crystal silicon substrates by December 2015
- Build and test technology development modules with silicon substrates and achieve 5" HPD by December 2016

## Applications:

- Backup technology for ESA's Athena mission
- Flagship and probe-class X-ray missions
- Explorer-type X-ray missions
- Sounding rocket and balloon experiments
- Medical research and diagnosis

TRL<sub>In</sub> = 3    TRL<sub>PI-Asserted</sub> = 4    TRL<sub>Target</sub> = 5