

**2012 Hardware Images**

**PCOS and COR Strategic Technology Portfolio**

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Testing thin grazing-incidence X-ray mirrors at MSFC X-ray test beam: guide tube from X-ray source to chamber (left); detector end of closed chamber (center); and Technology Demonstration Module (TDM), stage stack, and aperture mask in opened chamber (right).

**Significance:** This slumped glass technique provided some of the world's best thin grazing-angle X-ray mirror performance at the time, and was the predecessor for even better single-crystal silicon mirrors that are baselined for Lynx X-ray flagship mission concept

**Project Title:** Next Generation X-ray Optics: High Resolution ,Light Weight, and Low Cost

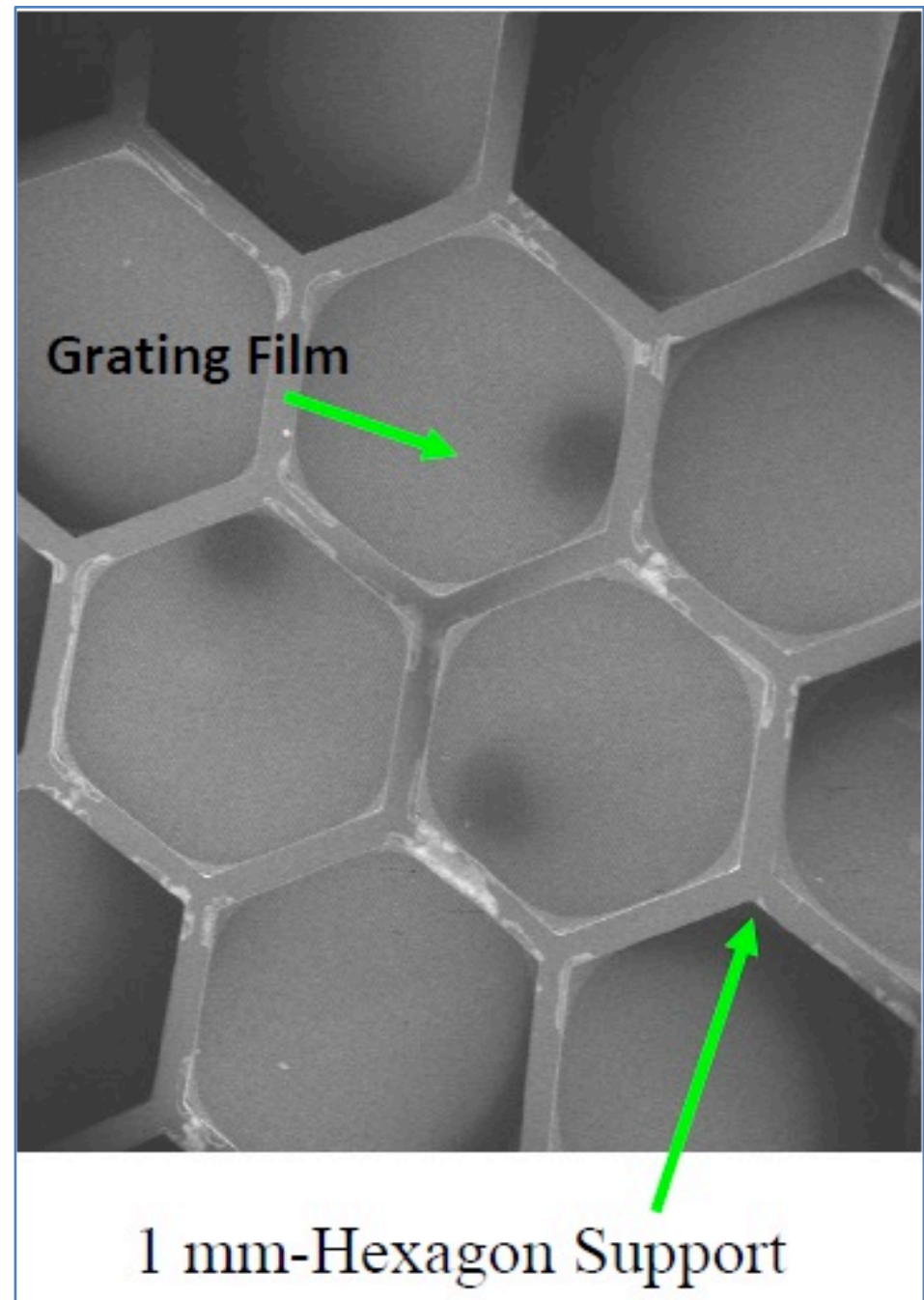
**PI:** Zhang, William (GSFC)

Scanning Electron Microscope (SEM)  
bottom view image of prototype X-ray  
Critical-Angle Transmission (CAT) grating

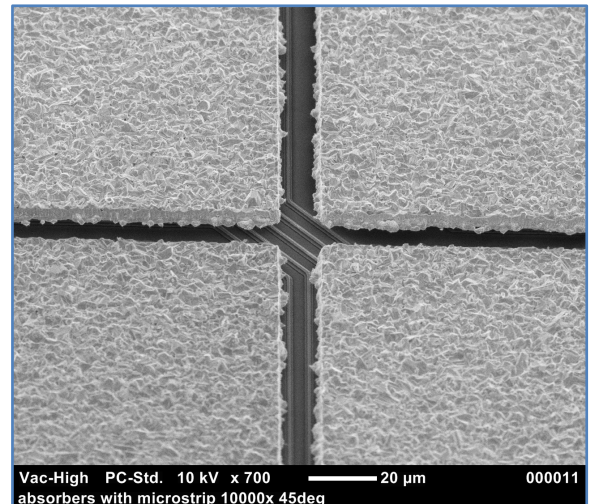
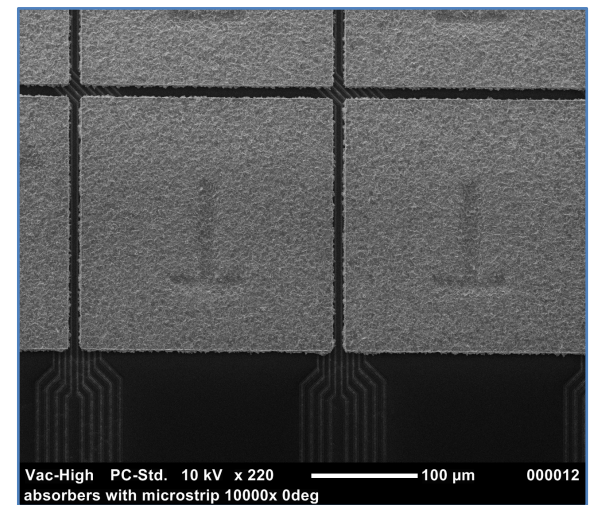
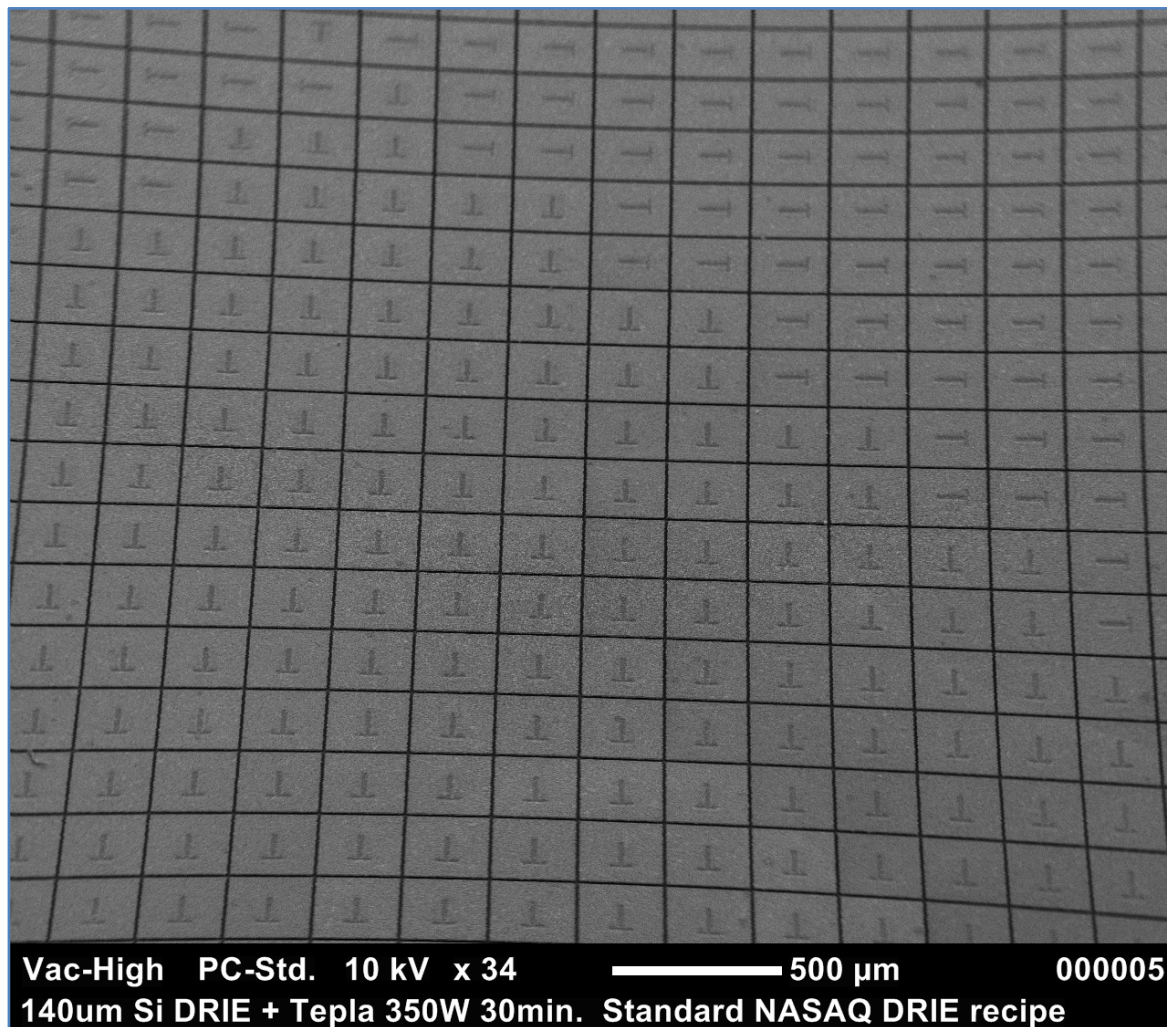
**Significance:** Highest-resolution X-ray  
grating technology; baselined for Lynx X-ray  
flagship mission concept

**Project Title:** Development of Fabrication  
Process for X-Ray CAT Gratings

**PI:** Mark Schattenburg (MIT Kavli Institute  
for Astrophysics and Space Research)







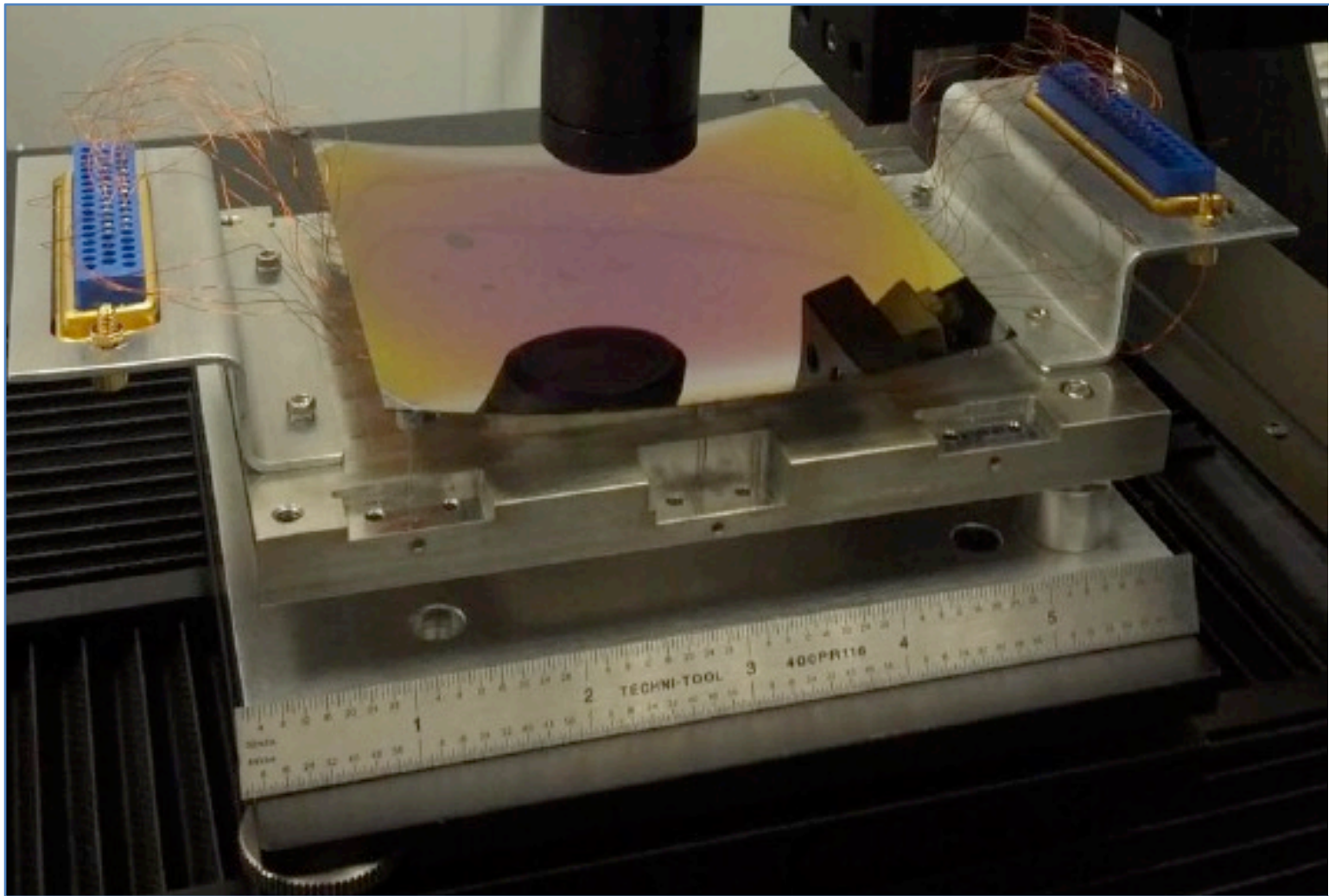
## Scanning Electron Microscope (SEM) of ATHENA Transition-Edge-Sensor (TES) arrays (32×32 pixels on 250-μm pitch)

**Significance:** TES microcalorimeters offer energy resolution for advanced X-ray observatories such as the European ATHENA mission

**Project Title:** High-Resolution Imaging X-ray Spectrometer

**PI:** Caroline Kilbourne (GSFC)





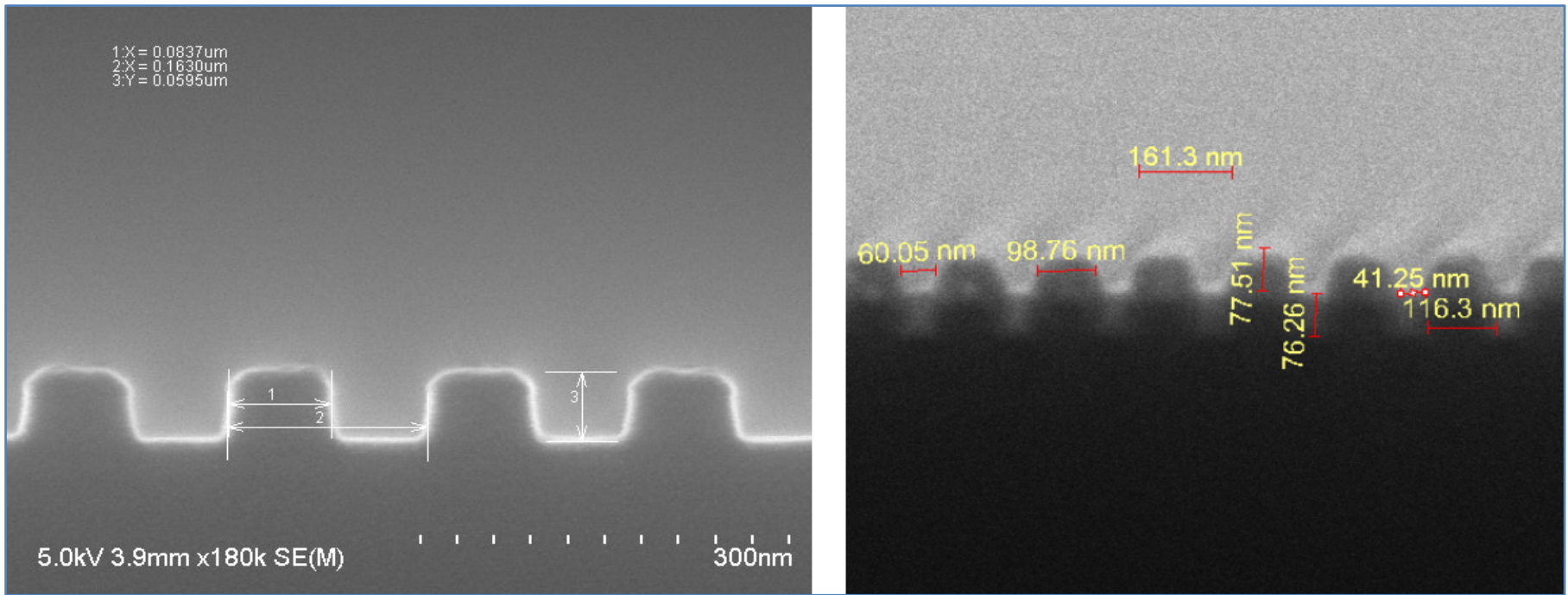
Mirror bonded to metrology mount during testing with piezo cell leads visible (piezo layer is hidden on the bottom side) as part of development effort of adjustable thin X-ray mirrors

**Significance:** Adjustable X-ray optics are a backup technology for the Lynx large mission concept

**Project Title:** Adjustable X-ray Optics with Sub-Arcsecond Imaging

**PI:** Paul Reid (SAO)





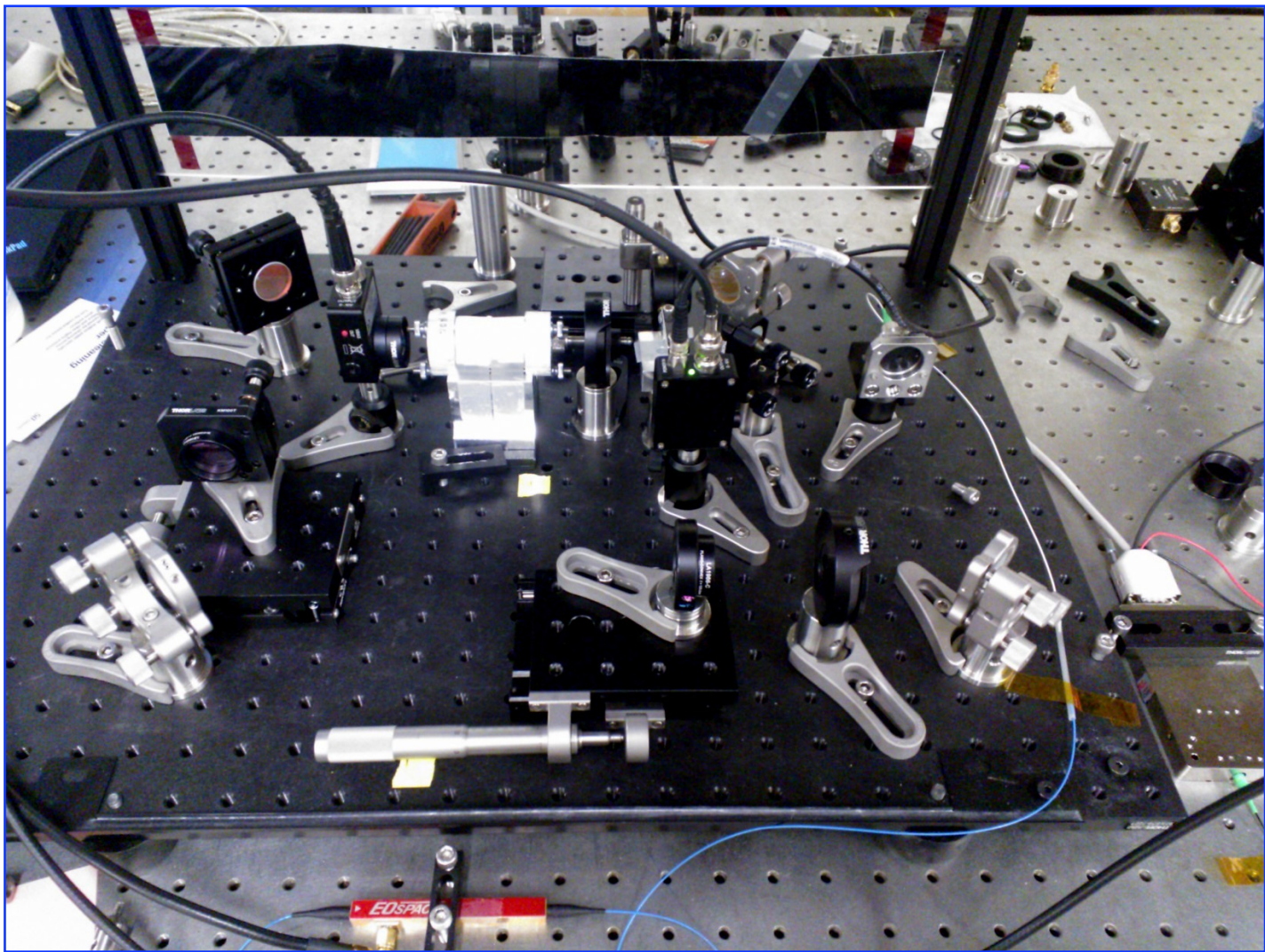
A pre-master with radial grooves at high density ( $\sim 6100$  grooves/mm), laminar grating in single crystal Si on path to developing off-plane X-ray reflection grating

**Significance:** X-ray reflection gratings enable high throughput, high spectral resolving power below 2 keV, a spectral band holding major astrophysics interest

**Project Title:** Off-Plane Grating Arrays for Future Missions

**PI:** Randall McEntaffer (PSU)





Lab test setup with 1570-nm laser (right hand side) locked to quartz cavity (center, white)

**Significance:** A highly stable laser simultaneously locked to a cavity and a molecular transition at a telecom wavelength can provide a highly coherent light source for future missions

**Project Title:** Laser Stabilization with CO

**PI:** John Lipa (Stanford University)