



2016 Hardware Images

PCOS and COR Strategic Technology Portfolio

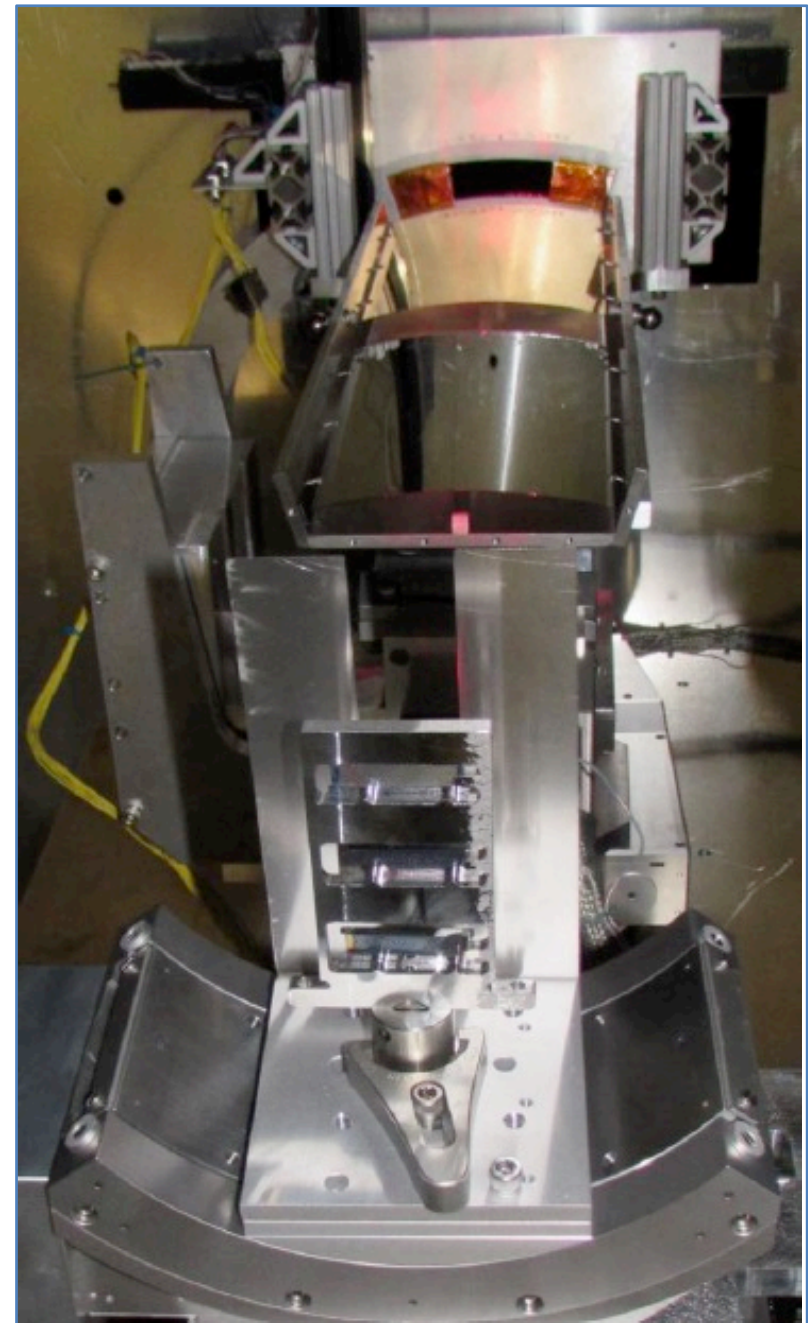
For more information about these technologies visit our Technology Database (<http://www.astrostrategictech.us>)

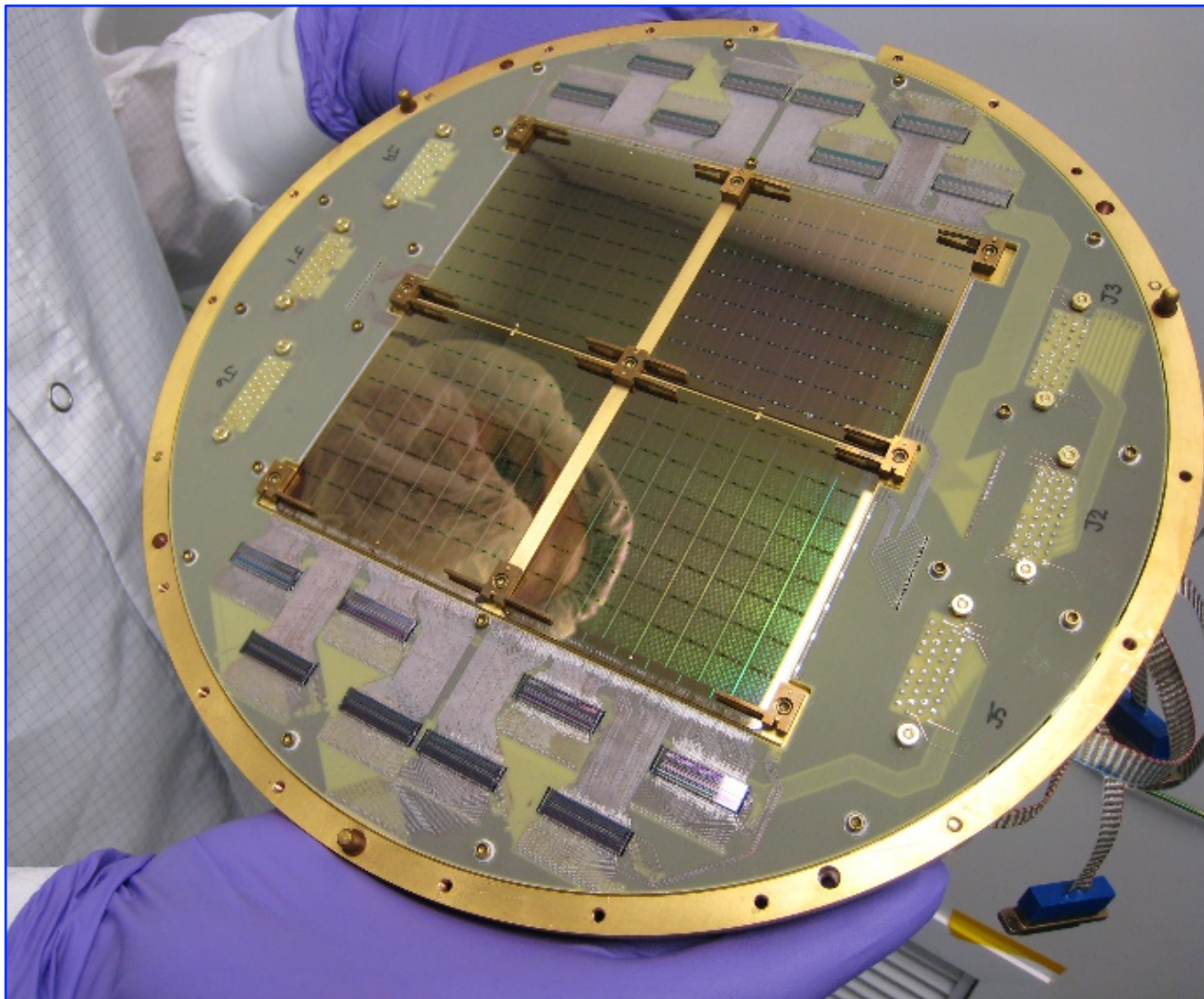
X-ray Critical-Angle Transmission (CAT) gratings during optical alignment

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

Project Title: Development of a CAT Grating Spectrometer

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



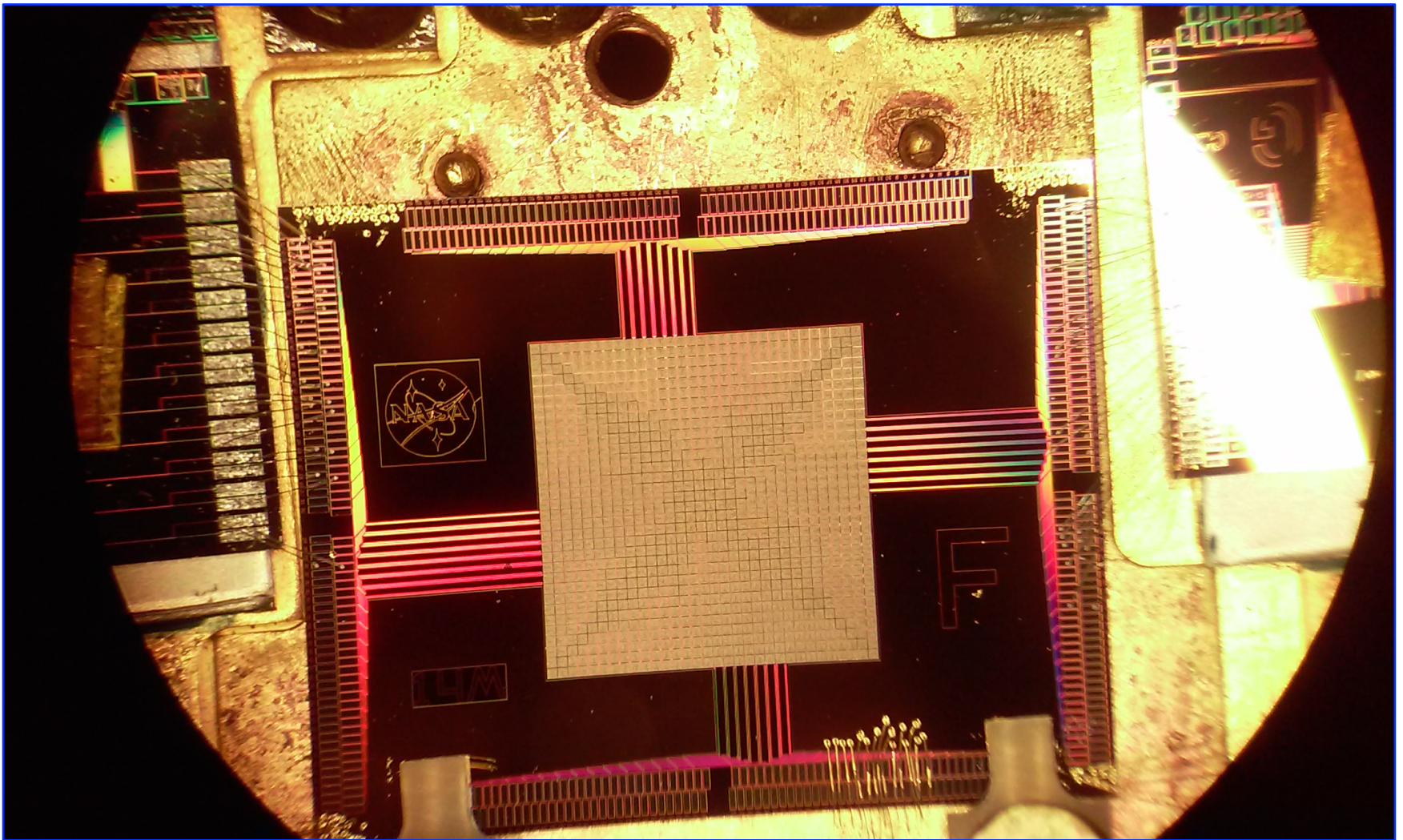


Large-format antenna-coupled bolometer arrays for Cosmic Microwave Background (CMB) polarimetry

Significance: Developing antenna designs providing sensitivity, stability, and minimized particle susceptibility for bands required by the Inflation Probe, enabling identification of Inflation instants after the Big Bang

Project Title: Planar Antenna-Coupled Superconducting Detectors for CMB Polarimetry

PI: James Bock (JPL/Caltech)

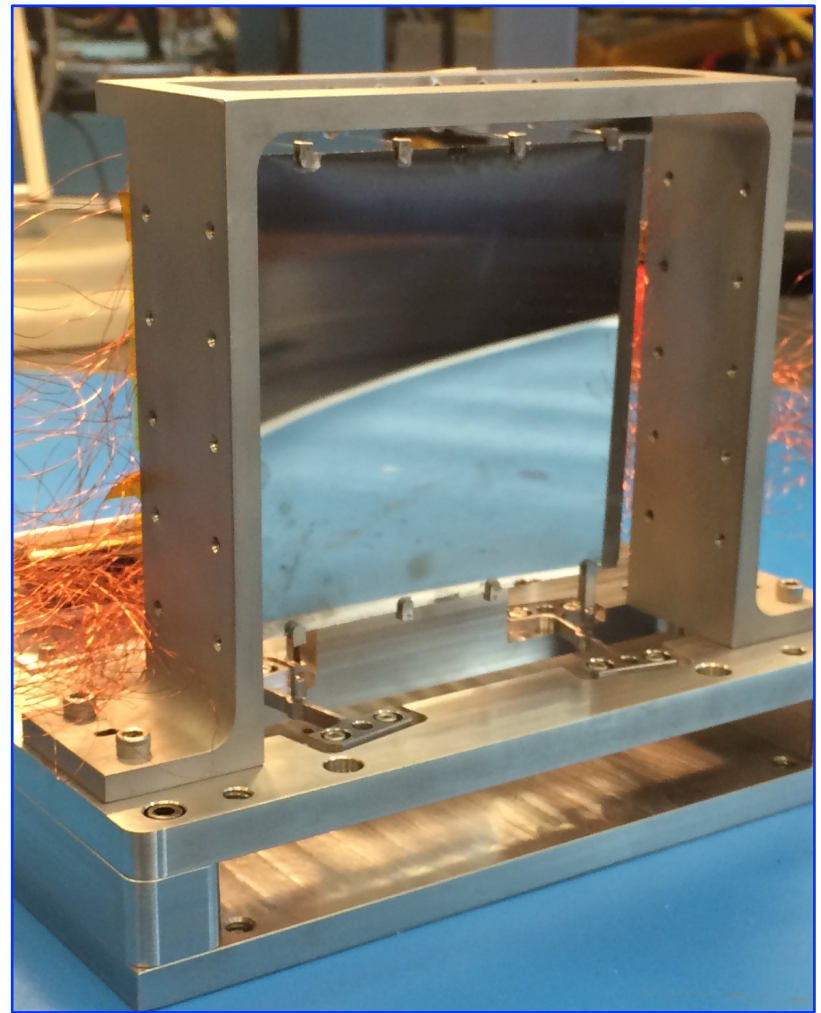
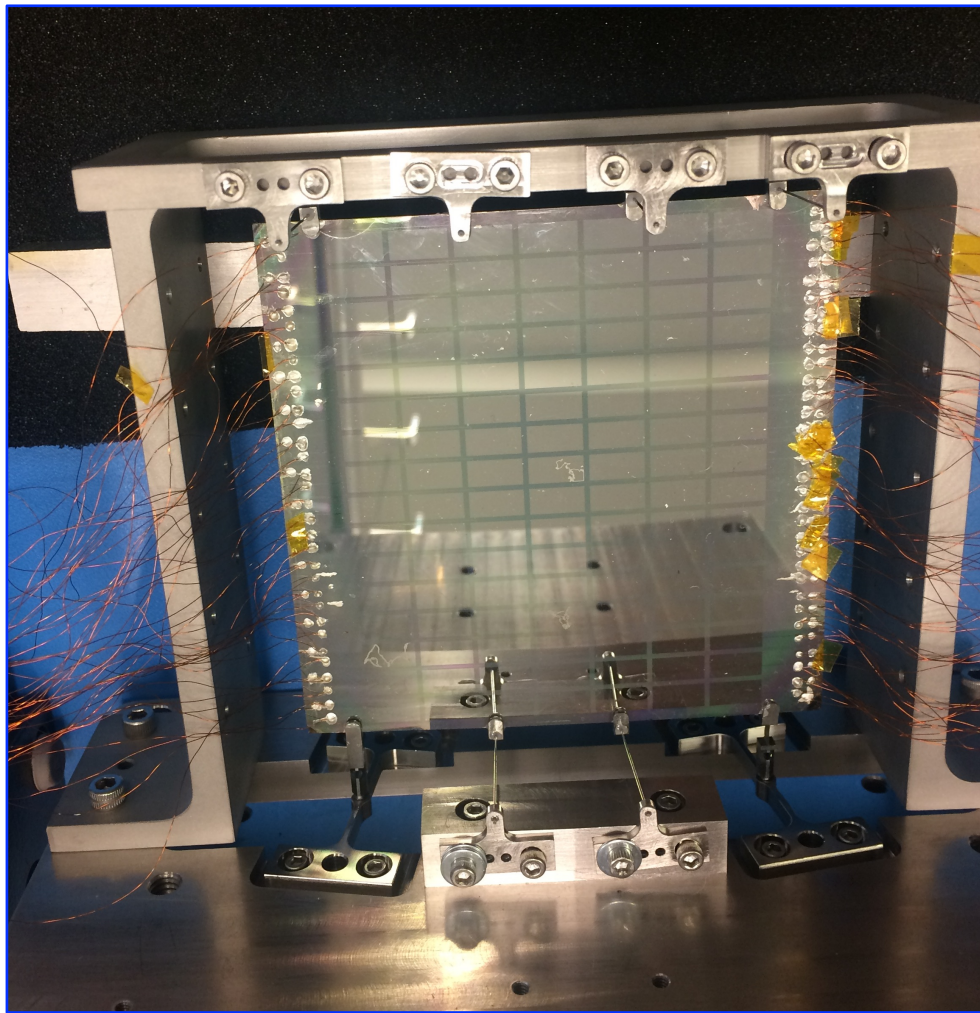


Candidate demonstration model Transition-Edge Sensors (TESs) array for the ATHENA X-ray Integral Field Unit (X-IFU)

Significance: TES microcalorimeters offer energy resolution for the European ATHENA mission

Project Title: Providing enabling and enhancing technologies for a demonstration model of the ATHENA X-IFU

PI: Caroline Kilbourne (GSFC)

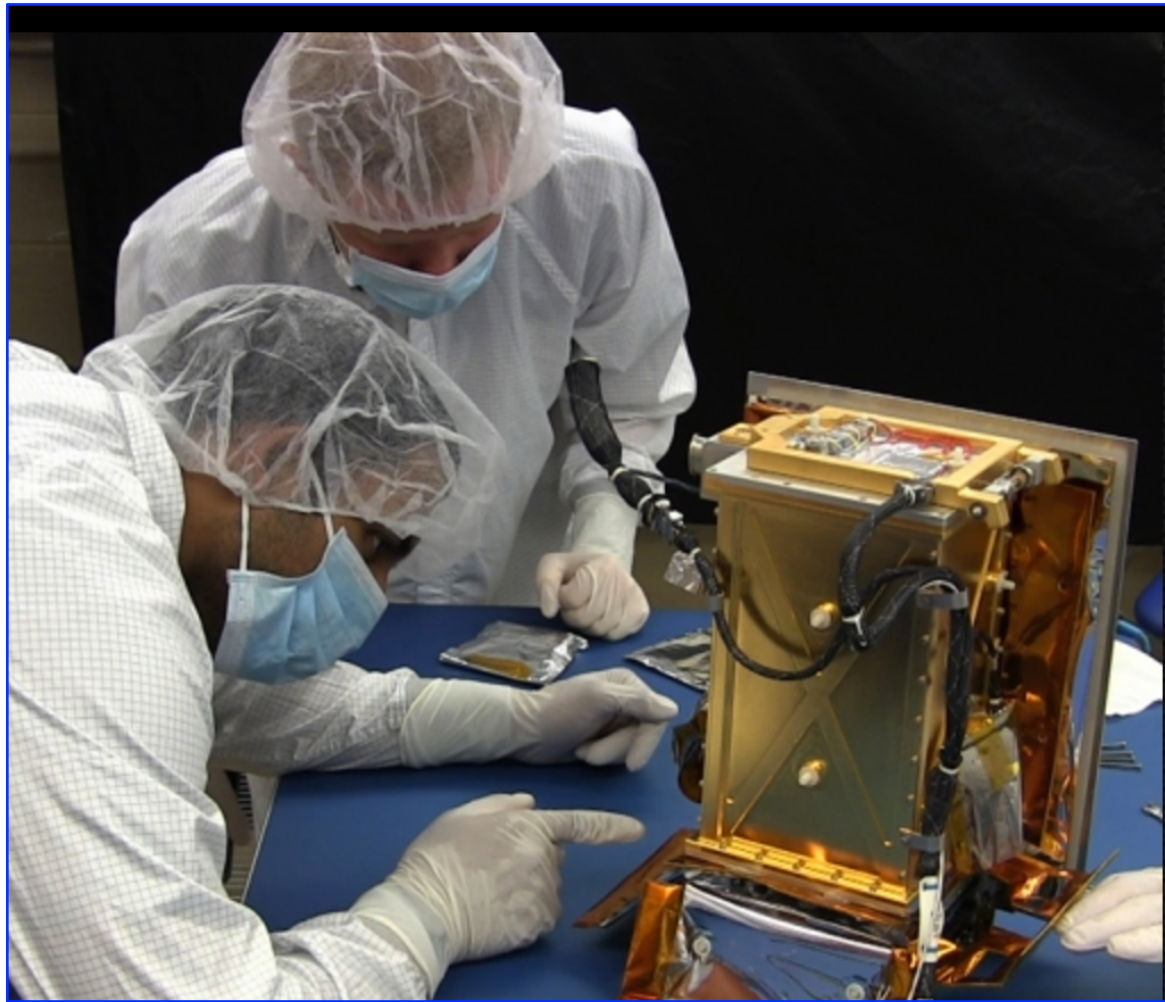


Mounted adjustable cylindrical X-ray mirror showing piezo cells and wiring

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

Project Title: Development of 0.5-Arc-second Adjustable Grazing-Incidence X-ray Mirrors for the SMART-X Mission Concept

PI: Paul Reid (SAO)

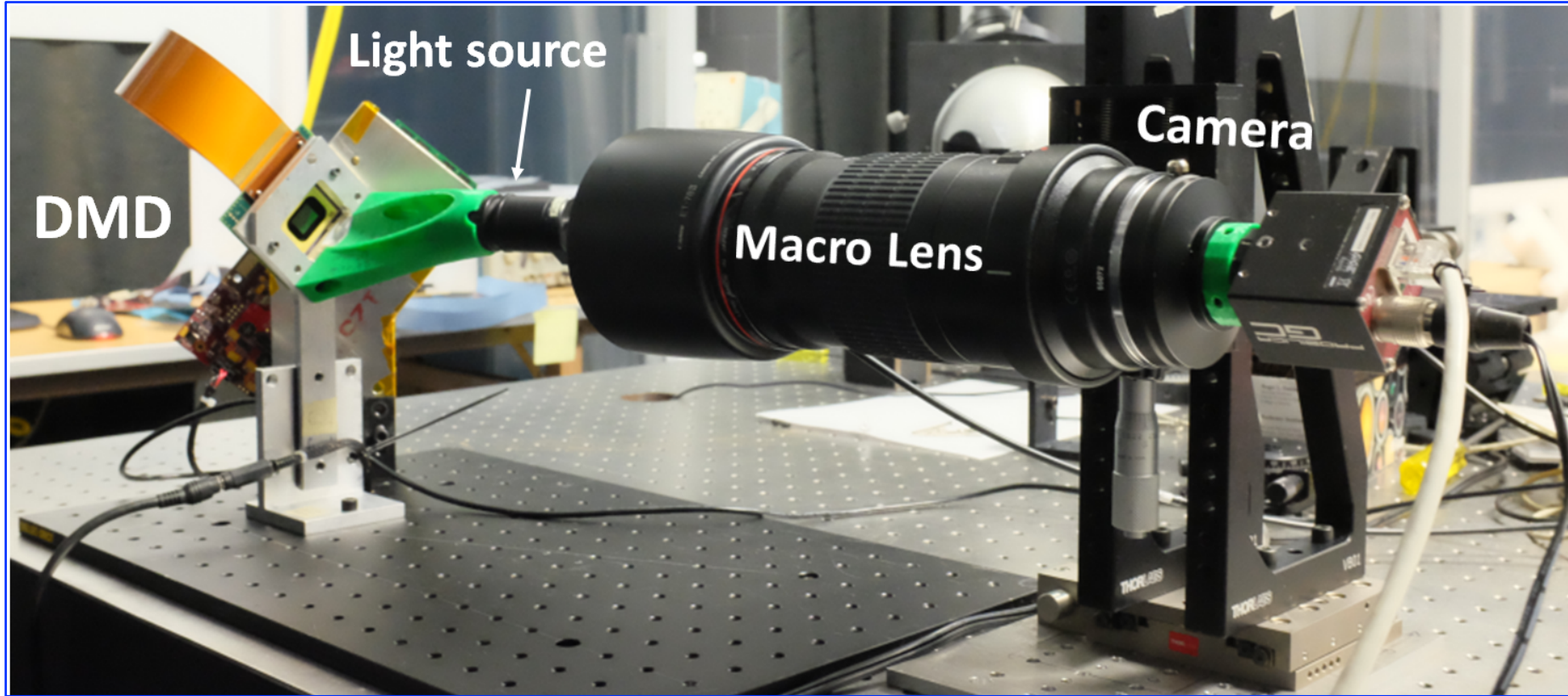


Students working on REXIS, a student-built instrument deployed on the OSIRIS-REx mission to Asteroid Bennu, that deployed with directly deposited filter on its X-ray CCDs

Significance: X-ray detectors operate far better when filters allow X-ray photons through and block longer wavelength light

Project Title: Directly-Deposited Blocking Filters for X-ray Imaging Detectors

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

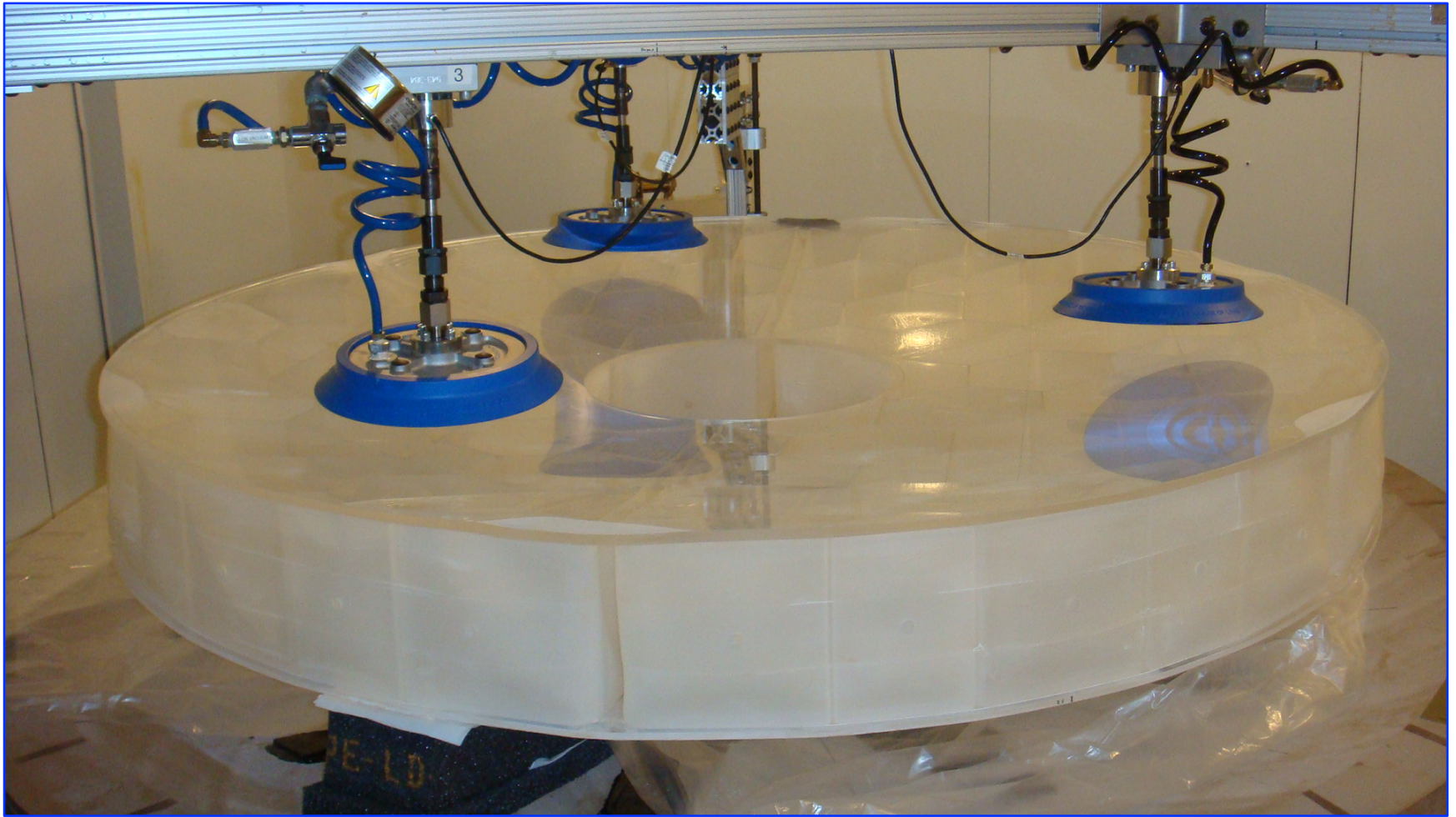


Detecting tripped micro-mirrors in Digital Micro-mirror Device (DMD) during vibration and shock testing done as part of flight qualification

Significance: Replacing windows of commercially available DMDs may enable far-UV multi-object spectrometry in future missions

Project Title: Development of DMDs for Far-UV Applications

PI: Zoran Ninkov (RIT)



1.5-m mirror blank after grinding and polishing

Significance: Deep-core manufacturing enables 4-m-class mirrors such as planned for the HabEx exoplanet observatory concept with significantly lower cost and risk

Project Title: Advanced Mirror Technology Development (AMTD) for Very Large Space Telescopes

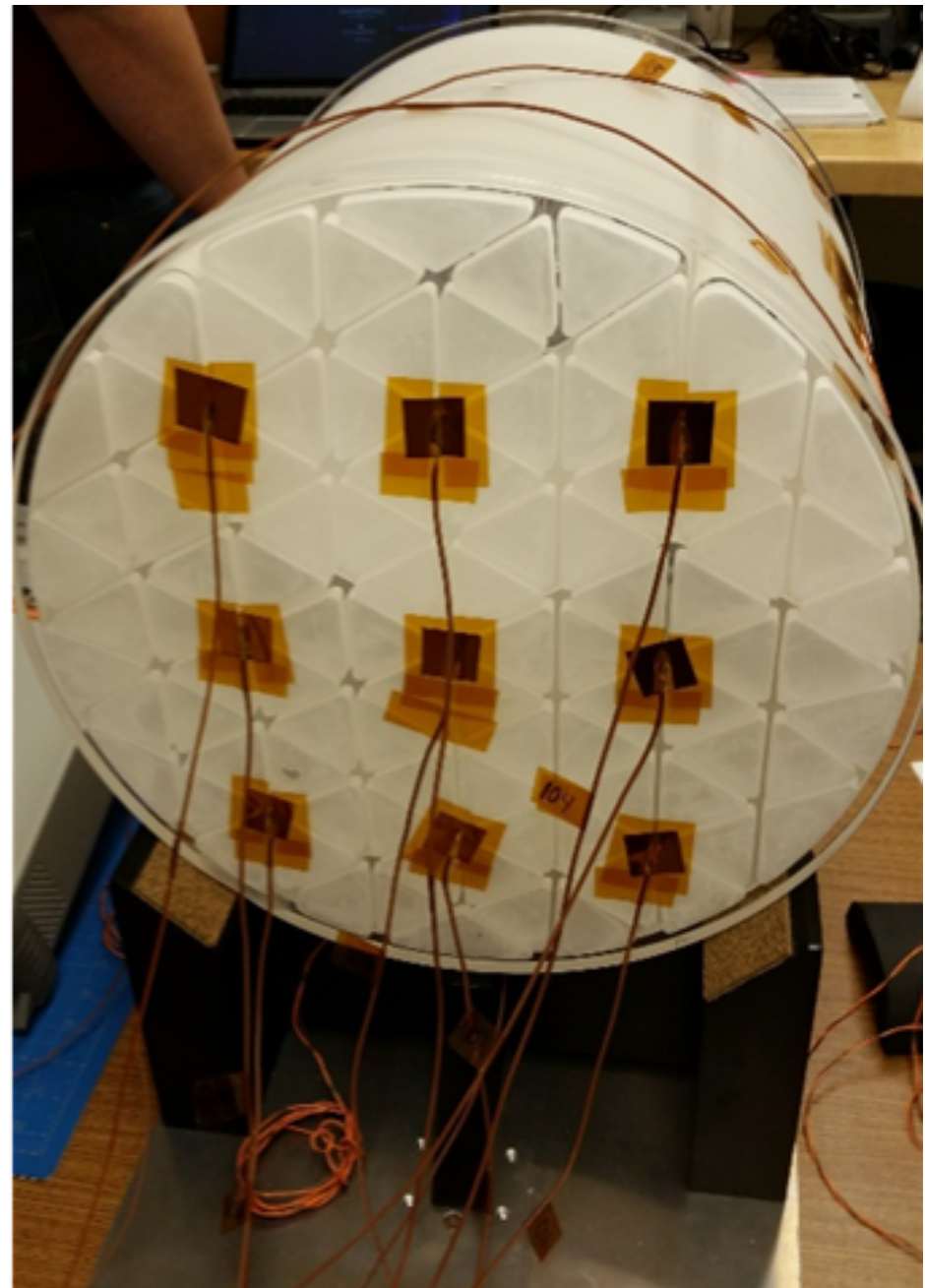
PI: H. Philip Stahl (MSFC)

1.5-m mirror with strip heaters placed at 120° intervals on its outside, and 18 thermocouples on its back and sides, as well as measuring the ambient temperature

Significance: This technology may enable required ultra-stability (~ 10 pm) for HabEx and LUVOIR missions

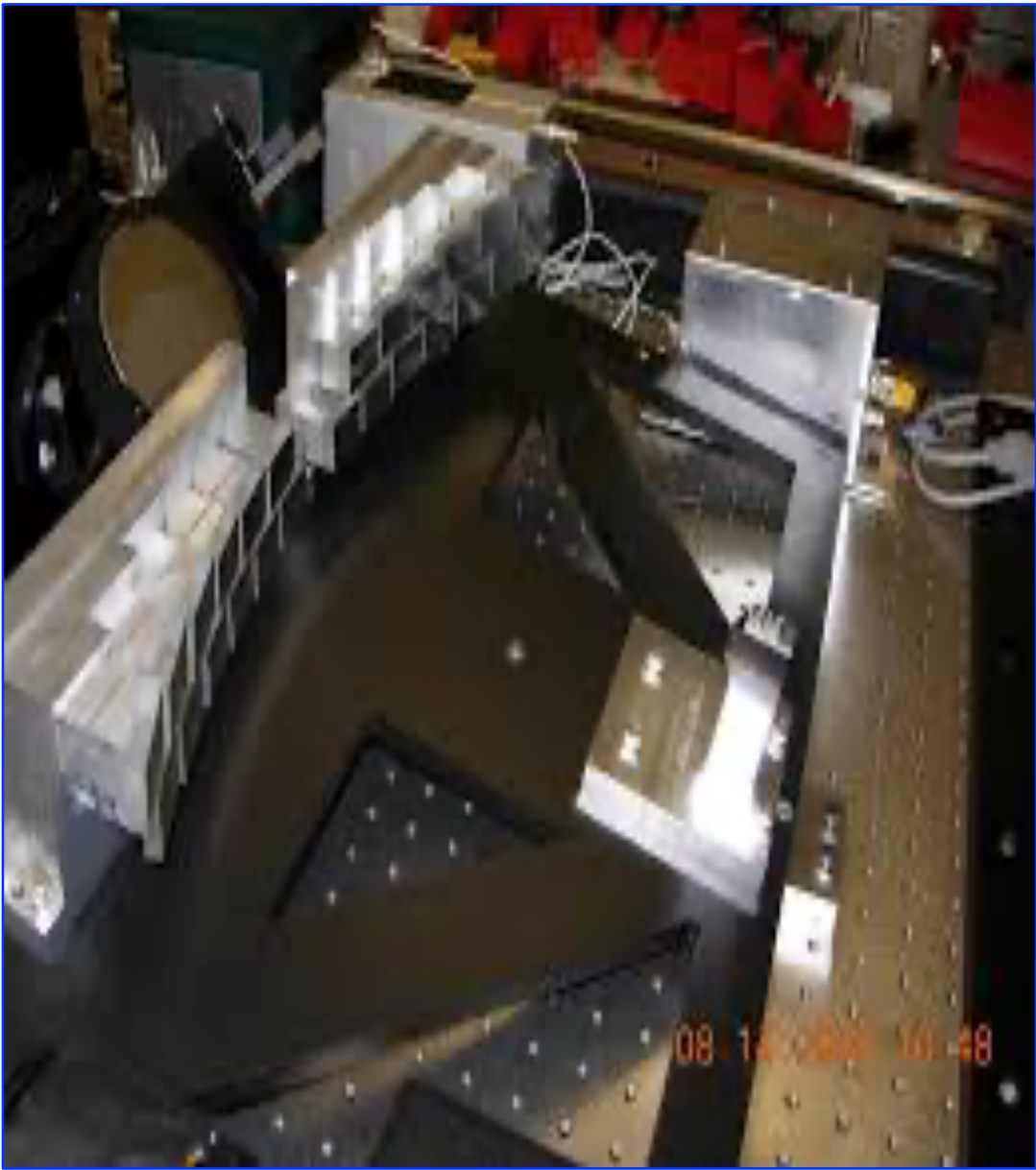
Project Title: Predictive Thermal Control (PTC)
Technology to enable Thermally Stable Telescopes

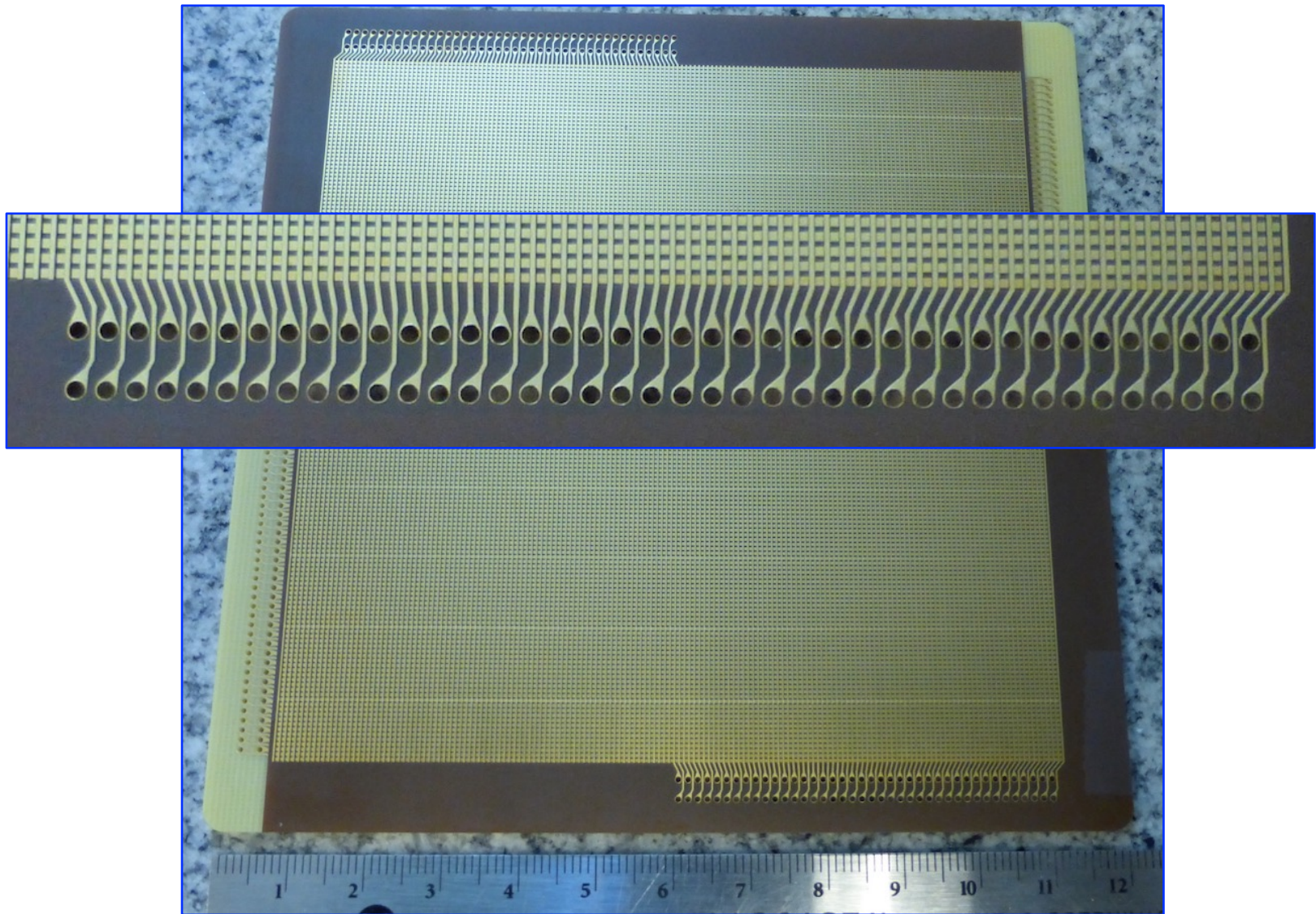
PI: H. Philip Stahl (MSFC)



Delta-doped Electron-Multiplied CCD
detectors (EMCCD) deployed at Palomar

Significance: Advanced detectors developed by this project are baselined by SHIELDS, HabEx, LUVOIR, and ground facilities **Project Title:** Advanced FUV/UV/Visible Photon-Counting and Ultralow-Noise Detectors
PI: Shouleh Nikzad (JPL/Caltech)



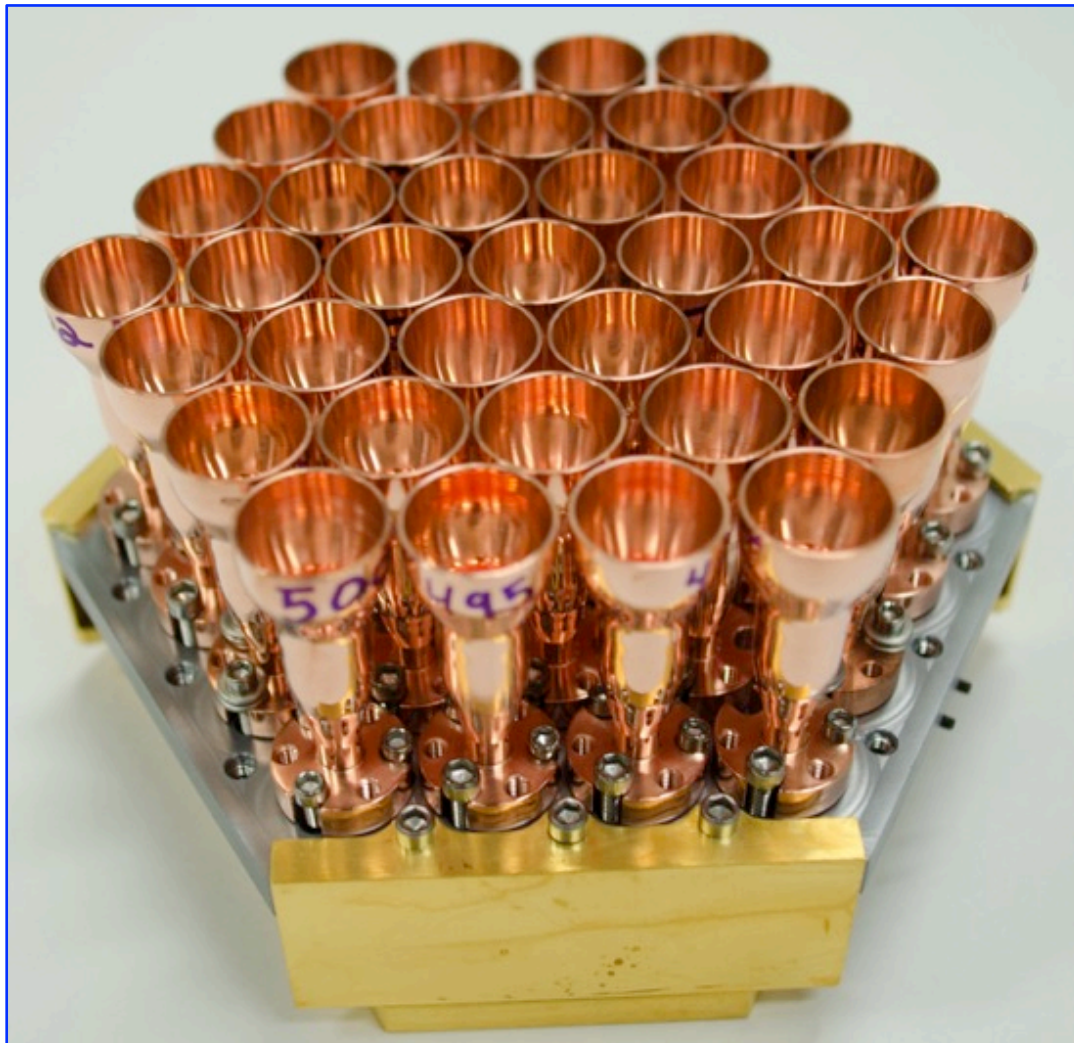


100 mm polyimide anode used for 100×100 mm² Multi-Channel Plate (MCP) detector

Significance: Large-format low-noise detectors may enable future far-UV missions

Project Title: Development of 100×100 mm² photon-counting UV detectors

PI: John Vallergera (UC Berkeley)

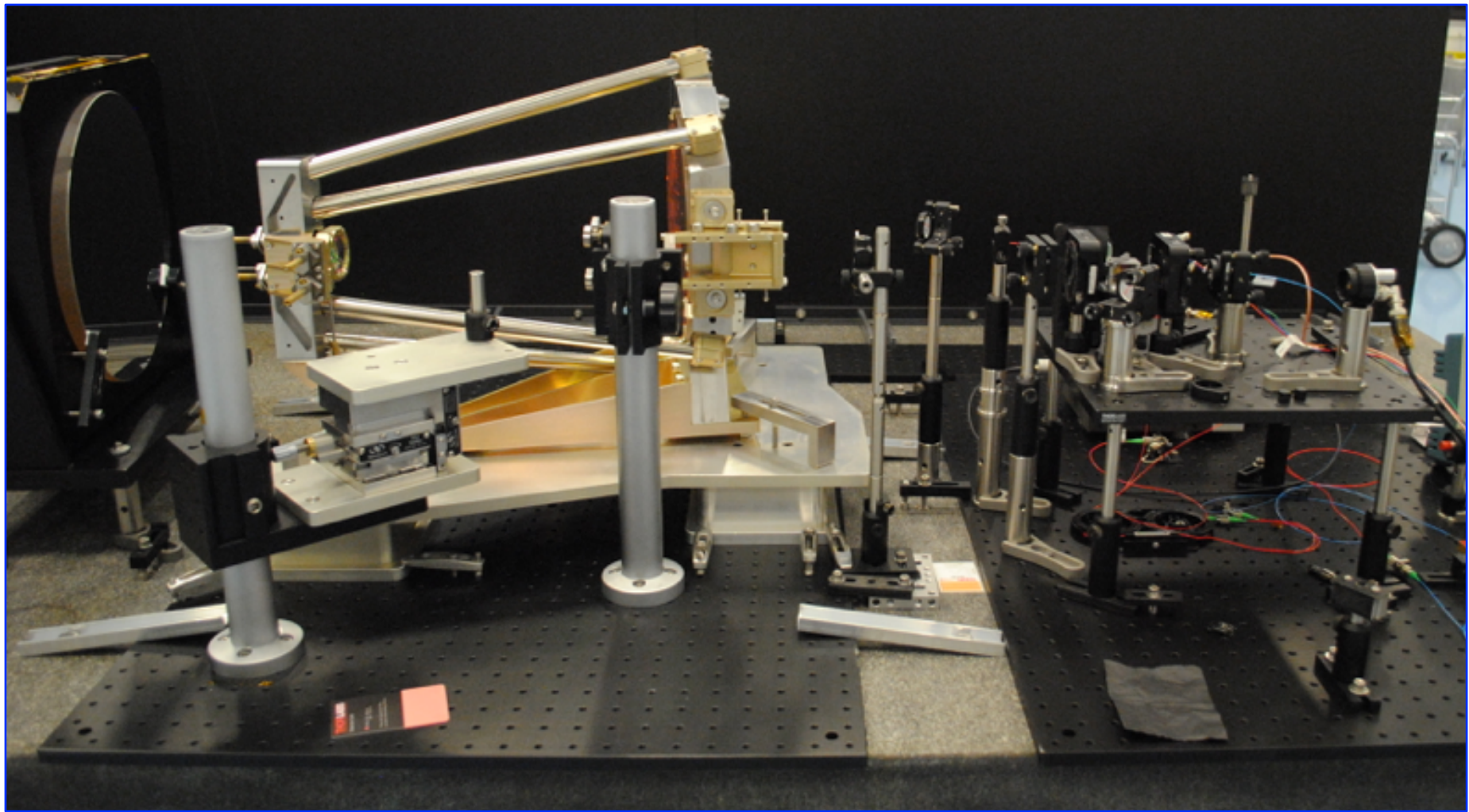


90-GHz feedhorn-coupled focal plane array for performing Cosmic Microwave Background (CMB) measurements

Significance: CMB measurements may enable identification of the “Inflation” cosmologists believe may have occurred instants after the Big Bang

Project Title: High Efficiency Feedhorn-Coupled TES-based Detectors for CMB Polarization

PI: Edward Wollack (GSFC)

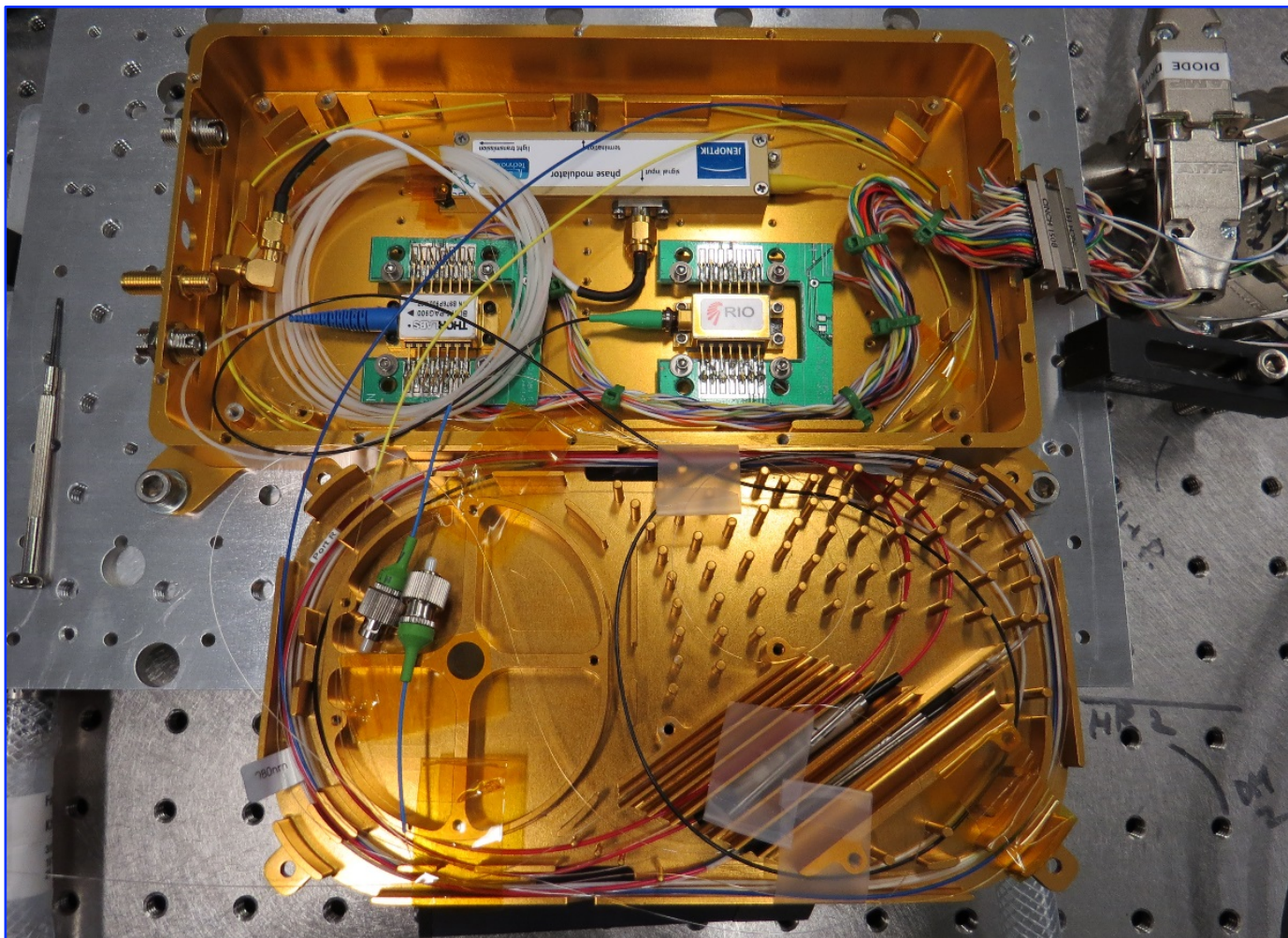


Measuring scattered light in prototype Laser Interferometer Space Antenna (LISA) telescope

Significance: The LISA gravitational-wave observatory crucially depends on collecting laser light from a remote spacecraft, millions of km away

Project Title: Telescope Development for the LISA Mission

PI: Jeffrey Livas (GSFC)

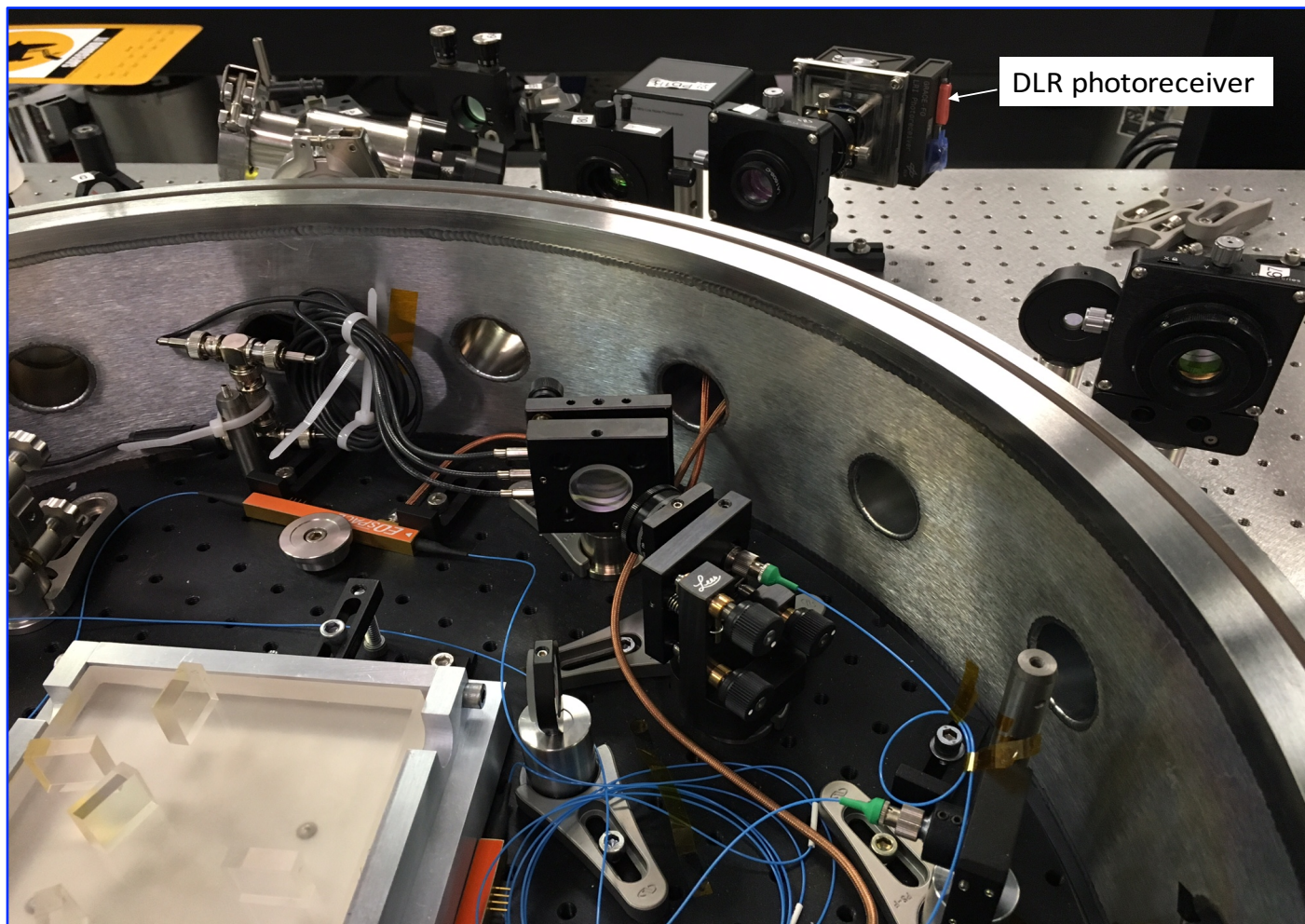


Prototype laser oscillator and pre-amplifier for lasers enabling the Laser Interferometer Space Antenna (LISA) gravitational-wave observatory

Significance: LISA crucially depends on lasers to allow interferometric measurement of the multi-million-km distance between the three spacecraft; technology readiness level (TRL) of 5 is needed for infusion into the mission

Project Title: Demonstration of a TRL-5 Laser System for LISA

PI: Jordan Camp (GSFC)

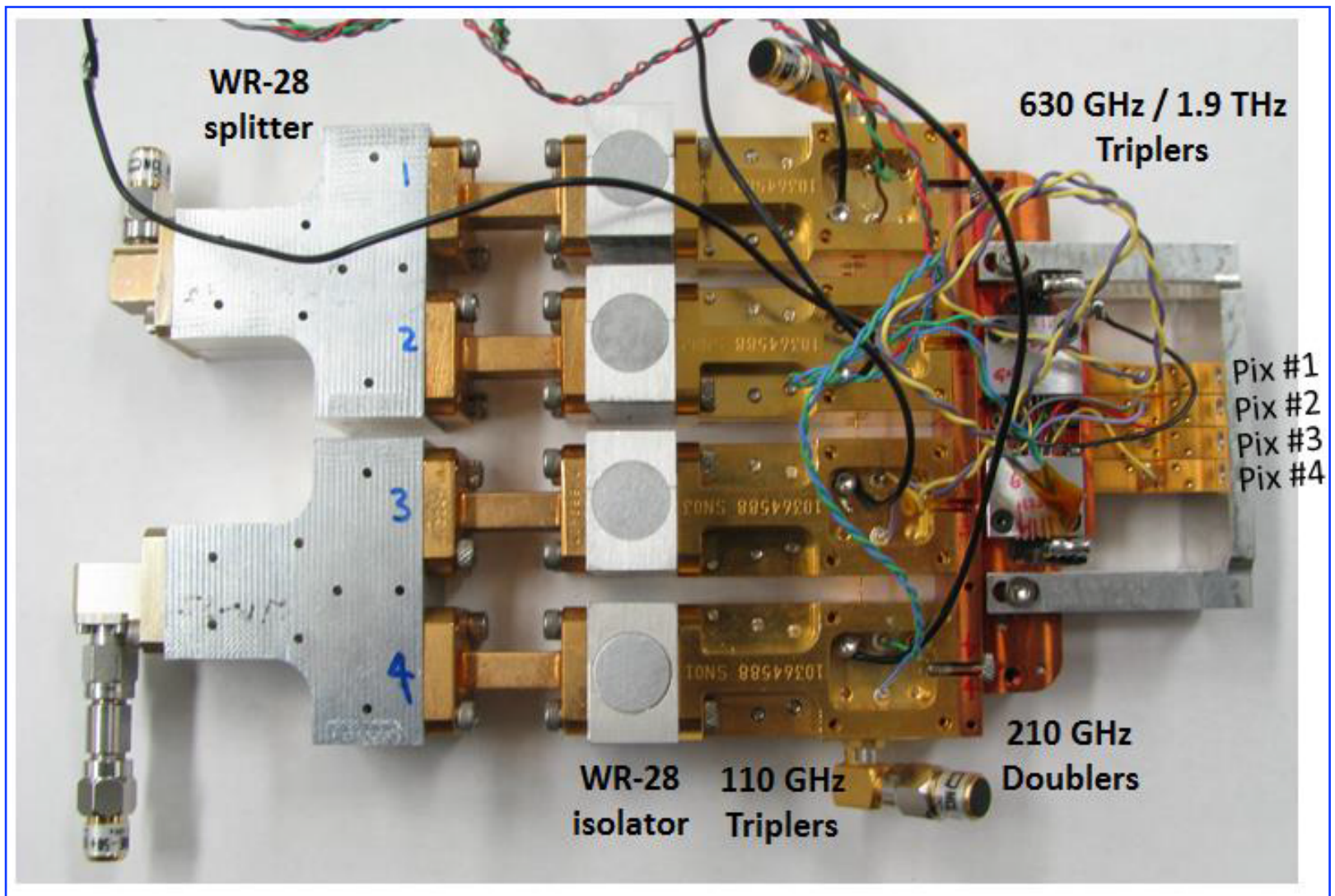


GRACE Follow-On photo-receivers integrated into testbed as part of phasemeter development for the Laser Interferometer Space Antenna (LISA) gravitational-wave (GW) observatory

Significance: LISA needs a phasemeter system to allow interferometric measurement of the multi-million-km distance between the three spacecraft

Project Title: Phase Measurement System Development for Interferometric GW Detectors

PI: William Klipstein (JPL)

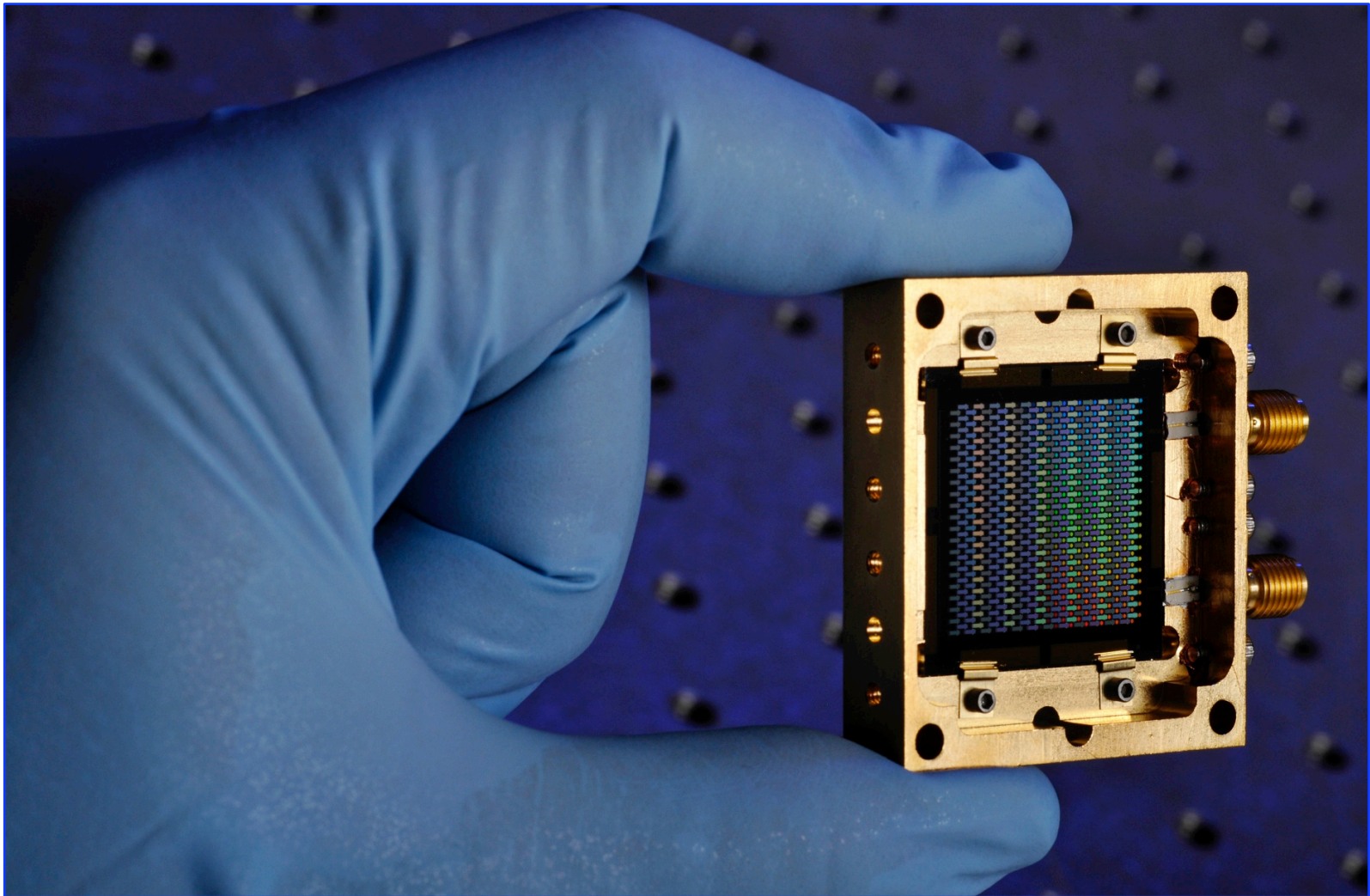


[Biasless 1.9-THz triplers developed for multi-pixel Local Oscillator \(LO\)](#)

Significance: This high-resolution multi-pixel far-IR detector technology may enable or enhance future missions

Project Title: A Far-IR Heterodyne Array Receiver for C+ and OI Mapping

PI: Imran Mehdi (JPL)



484-pixel 350-mm Kinetic Inductance Detector (KID) array

Significance: Polarization-sensitive arrays in the far-IR can provide critical information on the role of magnetic fields in galaxy formation and evolution, and star formation in our galaxy and nearby galaxies

Project Title: KID Imaging Arrays for Far-IR Astrophysics

PI: Jonas Zmuidzinas (JPL)

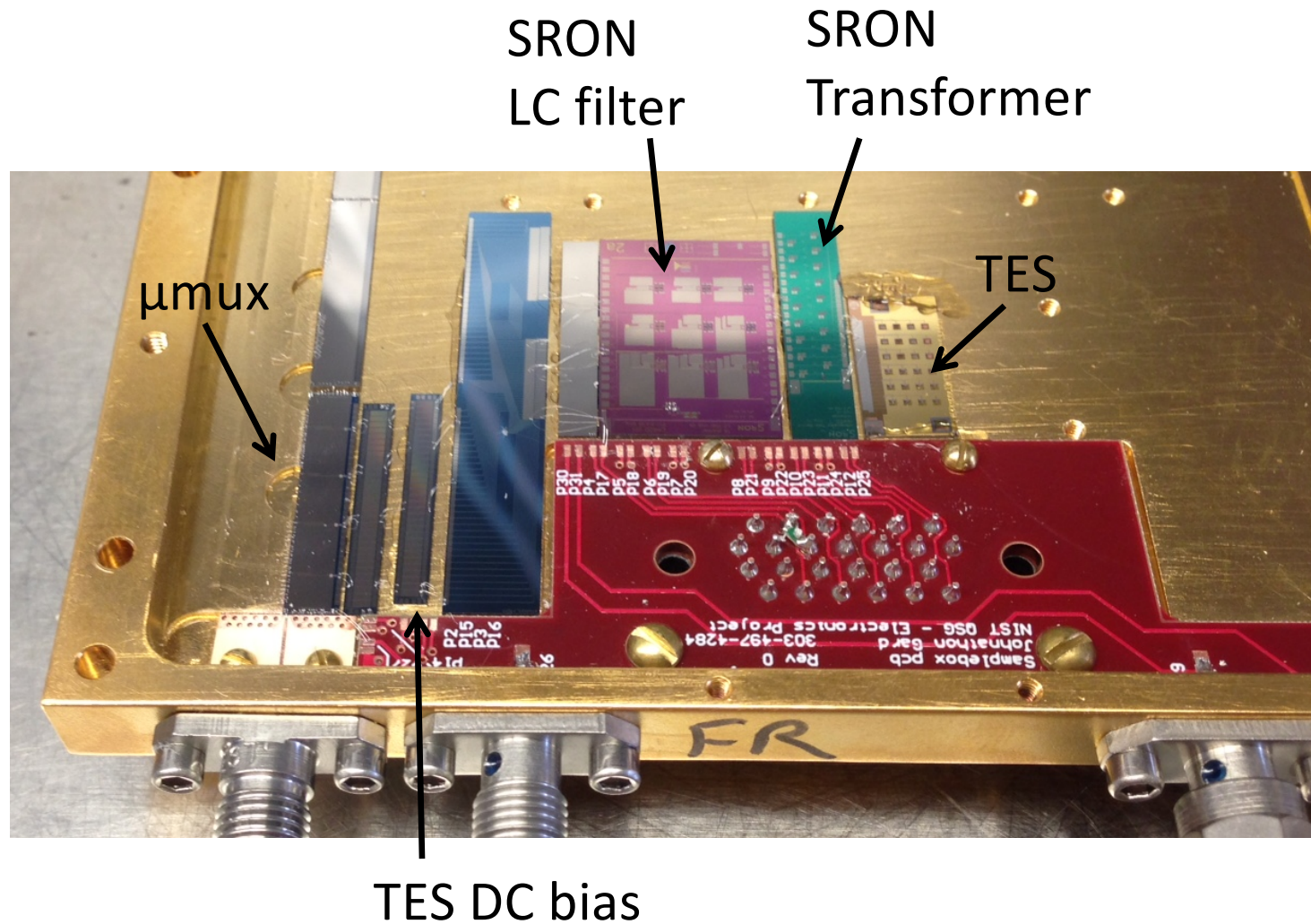


Atomic Layer Deposition (ALD) reactors at JPL used for developing advanced UV coatings

Significance: High-reflectivity, high-uniformity, wide-bandpass UV coatings are key for astrophysics and exoplanet studies

Project Title: UV Coatings, Materials and Processes for Advanced Telescope Optics

PI: Bala K. Balasubramanian (JPL)

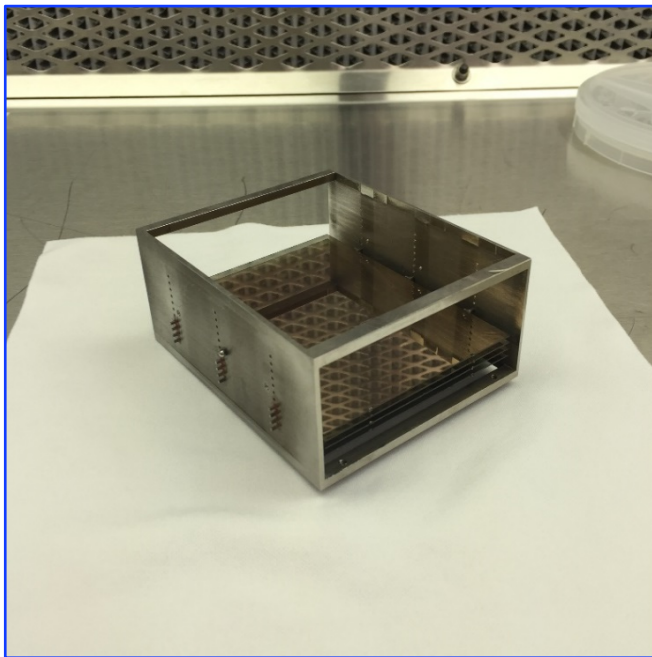
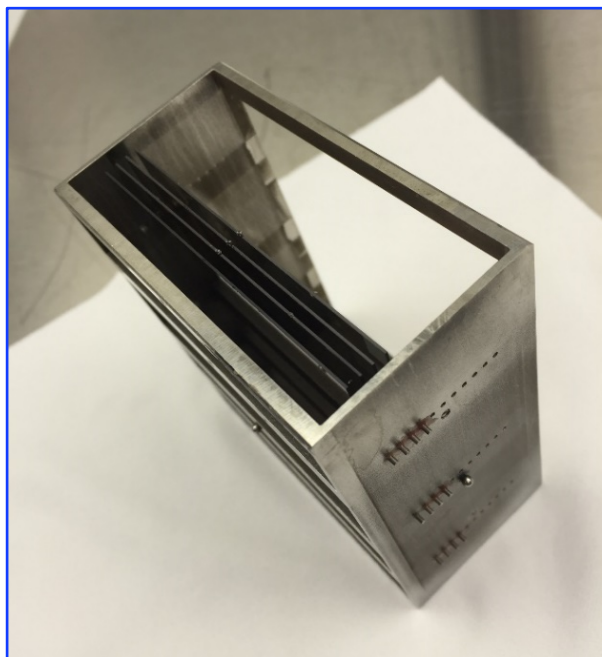


Test box for characterizing AC- and DC-biased Transition-Edge Sensors (TESs)

Significance: AC-biased TESs and Frequency Division Multiplexing are ATHENA's baseline readout architecture

Project Title: Technology Development for an AC-Multiplexed Calorimeter for ATHENA

PI: Joel Ullom (NIST)



Four X-ray reflection gratings aligned into a single module for testing

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

Project Title: Reflection Grating Modules: Alignment and Testing

PI: Randall McEntaffer (PSU)