GMOX Team

• Johns Hopkins University
• Space Telescope Science Institute
• Rochester Institute of Technology (Z. Ninkov)
• Dunlap Observatory (S. Sivanandam)
Assembled Flight Instrument
NIRSpec / MOS
MSA: 4x (159@528mas x 365@267mas) m-shutters

R100 (375 pix/sp + slit tilt)

UDF z > 2
2300 in UDF
1728 in MSA FoV (for PA 316°)
880 in AZ (central 428 x 167 mas)
299 without spectra overlap (49 in the gap)
Instrument Development Capabilities at Johns Hopkins University

Stephen Smee
Research Scientist
Department of Physics and Astronomy
Johns Hopkins University
IDG at a Glance

• Seven engineers with core competence in a variety of engineering disciplines
  – Optical, mechanical, electrical, systems and software engineering
• Five full-time machinists (Physical Sciences Machine Shop)
• Personnel and discipline
  – Stephen Smee (Mechanical Engineer, Manager)
  – Joe Orndorff (Electronics/Software Engineer)
  – Steve Hope (Electronics/Software Engineer)
  – Robert Barkhouser (Optical Engineer)
  – Randy Hammond (Mechanical Engineer)
  – Mirek Golebiowski (Mechanical Engineer)
  – Al Harding (Mechanical Engineer)
  – Dean Carpenter (Machinist/Supervisor)
  – Jeff Poston (Machinist)
  – Steve Shaut (Machinist)
IDG at a Glance...

• Instrumentation background
  – Ground and space based astronomy, condensed matter physics, high energy physics, medicine

• Most projects are in the realm of astronomy.

• Collaborators...
  – JHU (P&A, APL, Chemistry, Biology, Medical School)
  – Government institutions: NIST, NASA, LBNL, STScI, AAO
  – Private research institutions: Carnegie Observatories of Washington
  – Universities: Princeton, University of Maryland, University of Virginia, University of Washington, University of Wisconsin, Texas A&M...
Sloan Digital Sky Survey (SDSS) Multi-Object Fiber Spectrographs
Far Ultraviolet Spectroscopic Explorer (FUSE) Optical End-to-End Test
WIYN High Resolution Infrared Camera (WHIRC)
FourStar, The Near Infrared Imager for the Magellan Baade Telescope
APO Galactic Evolution Explorer (APOGEE)
Robert Stobie Spectrograph (RSS) at SALT
Near Infrared Dewar
GMT Wide-Field Multi-Object Optical Spectrograph (GMACS)
Cryogenic Photogrammetry for JWST (Goddard Space Flight Center)
Cryogenic Photogrammetry for JWST (Johnson Space Center)
Subaru Prime Focus Spectrograph (PFS) Cameras, CCDs, and Gratings
JHU/IDG Facilities

Physical Sciences Machine Shop

Optics/Detector lab

High bay

Engineering lab

Class 10k cleanroom
STScI

• Concept and operation of state-of-the-art space instrument in the UV, Optical and IR.
• Unique expertise with the operations of MEMS-based multi-slit spectrographs
    • IRMOS @ KPNO
    • NIRSpec @ JWST
    • SPACE -> Euclid
• Advanced Detector Testing Facility
• Advanced Optics Lab for novel instrument concept
IRMOS at Kitt Peak

- 848×600 TI DMD
- 0.8-2.5micron (near-IR)
- DMD operated at -45C
- Pathfinder for JWST/NIRSPEC
Observing with IRMOS

Figure 8: Texas Instruments DMD in test dewar operating at -50°C in IRMOS custom socket (without baffle). Note Lakeshore thermal diode mounted at top.
STScI
Operations Detector Lab

ODL Setup for QE measure

Lamp
Lockin and cable for PbSe diode
Blackbody
Russel B. Makidon Optics Laboratory

1 Class 100,000 clean room
2 Class 10,000 clean rooms.
Temperature, humidity, and pressure controlled; includes a vibration isolation pad original to the STScI construction.
  – JOST: JWST Optical Simulation Testbed
  – Non-Redundant Masking Interferometry
  – HICAT: High-contrast imager for Complex Aperture Telescopes
  – Polarimetry Testbed
Rochester Institute of Technology

• Our group at RIT have extensive experience and expertise in the testing and operation of TI DMDs and their use in astronomical applications. We have designed and built a multi-object spectrometer (RITMOS), have re-windowed commercial TI DMDs with MgF2, fused silca and sapphire windows, conducted scattering measurements on DMDs, conducted shake and vibration testing on DMDs, radiation testing and operated the devices in a liquid nitrogen dewar for low temperature testing.
Personnel

– Zoran Ninkov (RIT) Center for Imaging Science (CIS) & Astrophysical Sciences & Technology (AST) Program, overall DMD operations
– Alan Raisanen (RIT), Engineering, re-windowing and packaging DMDs, leak testing
– Dmitry Voriobov (RIT), CIS & AST, PhD/Post-Doc Testing of DMDs
– Anton Travinsky (RIT), CIS, PhD, Optical Design and Instrument Design
– Bob Krzaczek (RIT), CIS & SOFIA Operations, Software Operations and Data Archiving
– Kevin Kearney (3D Engineering), Optical Design
– Pete Hammond (Lightforce Technology) Mechanical Engineering Design

– Manuel Quijada (GSFC) coating and spectroscopy facility, Jonny Pellish (GSFC) radiation testing, Tim Schwartz (GSFC) shake and vibration testing
- Semiconductor & Microsystems Fabrication Laboratory (SMFL) at RIT for DMD windowing, inert atmosphere containment, RGA measurements, leak testing (www.smfl.rit.edu)
- Facilities associated with the Center for Detectors at RIT (see http://ridl.cfd.rit.edu/)
- Cary 5000 at NASA Goddard purchased by Co-I. For measurement of UV transmission and the BRDF of the DMD’s in the near-UV (~300 nm), optical (~600 nm), and IR (~1200 nm).
- GSFC Environmental Test Engineering (Code 549), vibration and shake testing
- LBNL 88” Cyclotron (proton testing)
- Texas A&M K500 88” Cyclotron (heavy ion testing)
- Extensive cleanroom and optical characterization infrastructure. Also a variety of low light cooled CCD camera and spectrometers.
- Mees Observatory for local testing of RITMOS
A GMOX precursor: RITMOS

Dunlap Observatory

- Complex Optical Design, Assembly, Testing
- Complete Instrument Design, Assembly, and Testing
- IR Detectors (Teledyne HxRGs)
- Cryogenic Systems
- Wavefront Sensors for Adaptive Optics
- Software Pipeline Development