Enhanced MgF_2 and LiF Over-Coated Al Mirrors for FUV Space Astronomy

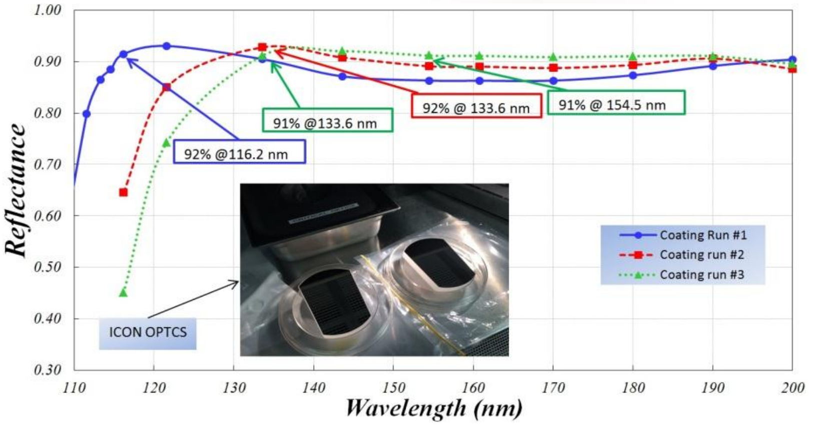
PI: Manuel A. Quijada / GSFC Code 551

Objectives and Key Challenges:

- Develop high-reflectivity coatings to increase system throughput, particularly in the far-UV (FUV) spectral range
- Study other dielectric fluoride coatings and other deposition technologies, such as Ion Beam Sputtering (IBS), expected to produce the nearest-to-ideal-morphology optical-thin-film coatings and thus low scatter

Significance of Work:

- High reflectivity (> 90-95%) in the 90 to 250 nm range will enhance throughput in UV telescopes
- Scaling coatings up to large diameter (1+ m) mirror substrates will enable large-aperture UV and/or UVOIR missions



Data from various test runs to produce coatings with over 90% reflectance for ICON spectral range

Approach:

- Retrofit a 2-m coating chamber with heaters/thermal shroud to perform Physical Vapor Depositions at high temperatures (200-300 C) to further improve performance of Al mirrors protected with either MgF_2 or LiF overcoats.
- Optimize deposition process of lanthanide trifluorides as high-index materials that when paired with either MgF_2 or LiF will enhance reflectance of Al mirrors at Lyman-alpha
- Establish the IBS coating process to optimize deposition of MgF_2 and LiF with extremely low absorptions at FUV wavelengths

Key Collaborators:

- Javier del Hoyo, Steve Rice, and Felix Threat (GSFC Code 551)
- Jeff Kruk and Charles Bowers (GSFC Code 665)

Latest Funded Period of Performance:

Oct 2011 – Sep 2014

Recent Accomplishments:

- ✓ Performed end-to-end testing of the three-step Physical Vapor Deposition (PVD) coating process in 2-m chamber to enable 1+ m class mirrors with either Al+MgF_2 or Al+LiF coatings for FUV applications
- ✓ Completed characterization of lanthanide trifluorides (GdF_3 and LuF_3) to pair them with low-index MgF_2 layers to produce narrow-band dielectric reflectors at FUV wavelengths
- ✓ Produced mirrors with reflectance over 90% in FUV for ICON and GOLD projects

Application:

- Application of these enhanced mirror coating technology will enable FUV missions to investigate the formation and history of planets, stars, galaxies, and cosmic structure; and how the elements of life in the universe arose

TRL_{In} = **3** $TRL_{PI\text{-}Asserted}$ = **4** TRL_{Target} = **4**