Deposited Blocking Filters for X-ray Detectors

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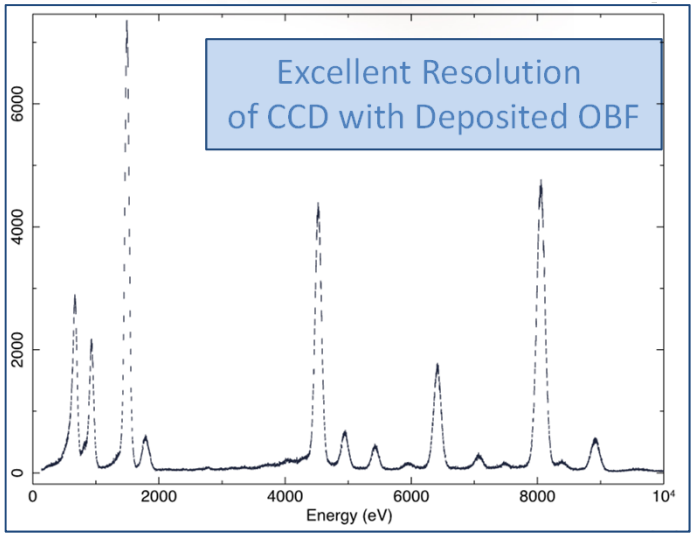
Objectives and Key Challenges:

- Silicon Imaging X-ray detectors require thin filters (<300 nm) to block noise/background from UV and optical light
- State-of-the-art, free-standing filters use fragile, thin substrates
- Objective: deposit blocking filter directly on CCD X-ray detector, eliminating substrate
- Challenges:
  - Deposit filter directly without compromising CCD performance
  - Deposit sufficiently thin, uniform filters

Significance of Work:

- Filter deposited on detector requires no fragile substrate
- Allows cheaper, more robust sensors (no vacuum housing!)
- Improves QE & makes larger focal planes practical



Approach:

- Exploit existing stocks of (engineering grade/flight spare) X-ray CCD detectors at MIT Lincoln Laboratory
- Screen, thin, passivate, package & apply filters to detectors
- Filter is Al with AlO_2 cap
- Start thick (220 nm Al), get progressively thinner
- Use existing MIT facilities for X-ray characterization
- Use existing & upgraded facilities for optical characterization

Key Collaborators:

- MIT Kavli Institute (Bautz, Kissel et al.)
- MIT Lincoln Laboratory (Suntharalingam, Ryu, Burke, O'Brien)

Current Funded Period of Performance:

Jul 1, 2012 – Jun 30, 2016

Accomplishments and Next Milestones:

- Reduced pinhole fraction to < 1% (OD<7) for 220nm OBF
- Tested devices 70nm & 100nm thick Al OBF. Optical blocking as expected.
- With REXIS, developed & qualified underside coating as effective countermeasure for near-IR leakagethrough package.
- Long-term stability test in progress; no degradation in 8 months
- Supported env. tests of REXIS flight CCDs/OBFs, achieved TRL-6, ***surpassing project goals.***
- Complete stability test and final publication by end date.

Application:

Every X-ray imaging or grating spectroscopy mission

- Explorers (Lobster, Arcus…)
- "Probes" (AEGIS, N_XGS, AXSIO, WFXT…)
- Flagship (Athena, X-ray surveyor)

TRLin = 5 TRLcurrent = 6 TRLtarget = 6