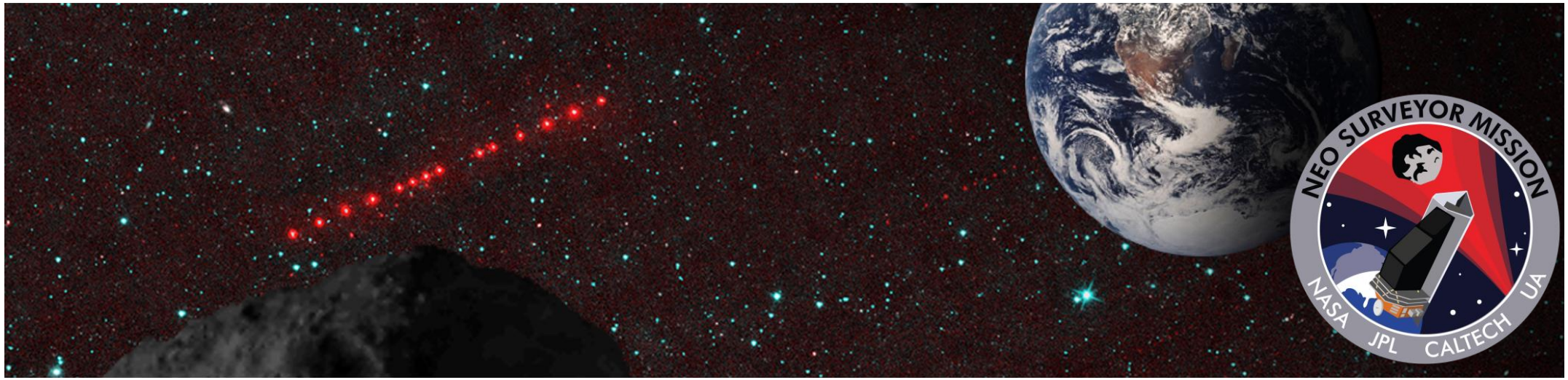


SPACE-QUALIFIED INFRARED FOCAL PLANE ARRAYS – A CRITICAL TECHNOLOGY FOR PLANETARY DEFENSE

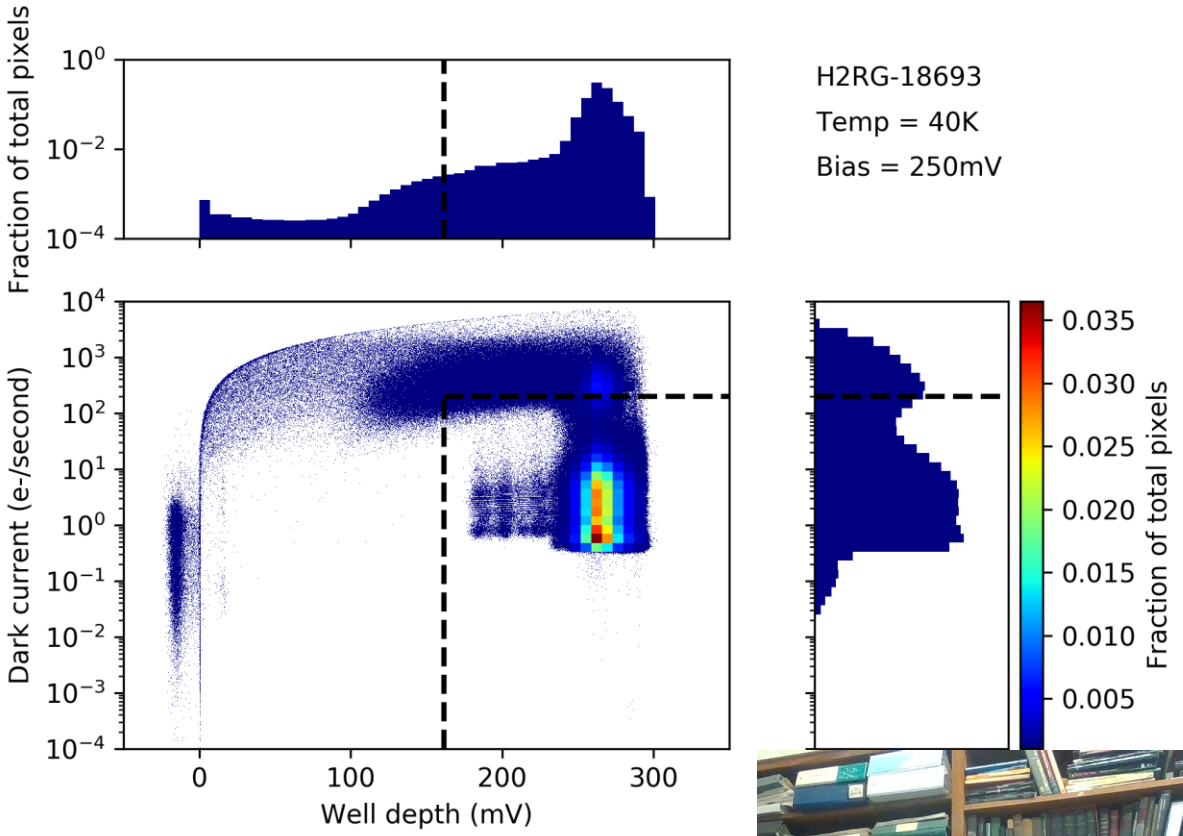
Judith Pipher, Mario Cabrera, Meghan Dorn, Mark Farris, William Forrest, Don Lee, Amy Mainzer, Jessica Maiten, Craig McMurtry, Jianmei Pan, Nicholas Reilly, Andre Wong, Majid Zandian, Gregory Zengilowski

NEO Surveyor

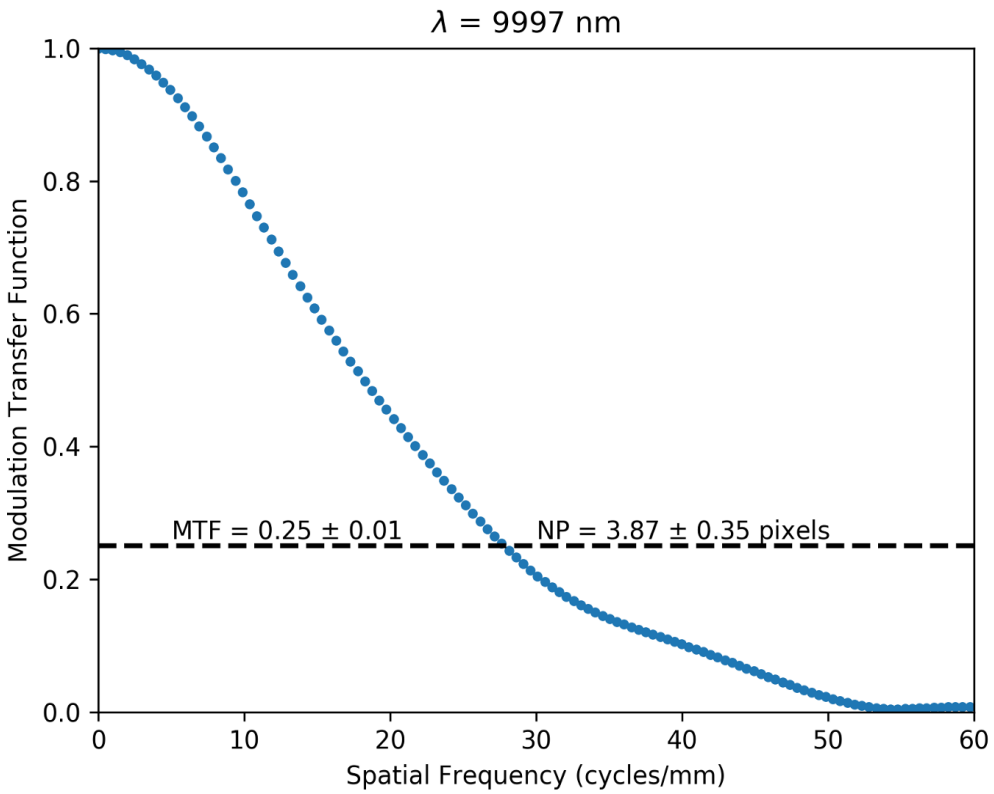
- NEO Surveyor is a proposed mission to comprehensively survey the population of Near Earth Objects (NEOs) > 140m diameter, identifying those NEOs that are potentially hazardous to Earth
  - NEOs are asteroids whose orbits have been altered by giant planets to travel near the Earth's orbit or comets
- Because the temperature of these NEOs is ~300K, two cameras consisting of four 2k x 2k arrays arranged in a row, covering 4-5.2 μm and 6-10 μm respectively, scan the ecliptic in a fashion optimizing NEO detection
  - Here discuss development of the 6-10 μm HgCdTe detector arrays

$Hg_{1-x}Cd_xTe$ composition parameter x ≈ 0.225 →10+ μm cutoff wavelength

- At 40K focal plane temperature (passively cooled) HgCdTe arrays with Cd fraction x ≈ 0.225 (relatively high Hg concentration) have cutoff wavelengths optimal for the survey, i.e. 10+ μm
- Requirements: QE > 55%, dark current < 200e-/s, Correlated double sampling noise < 36e-, well depth >44 ke-, operability >92%
- Development of low dark current and high well depth pixels at these wavelengths challenging because Hg concentration makes material soft hence prone to defects
- Majority of pixels in high well depth low dark current portion of Figure (rectangle dashed lines)

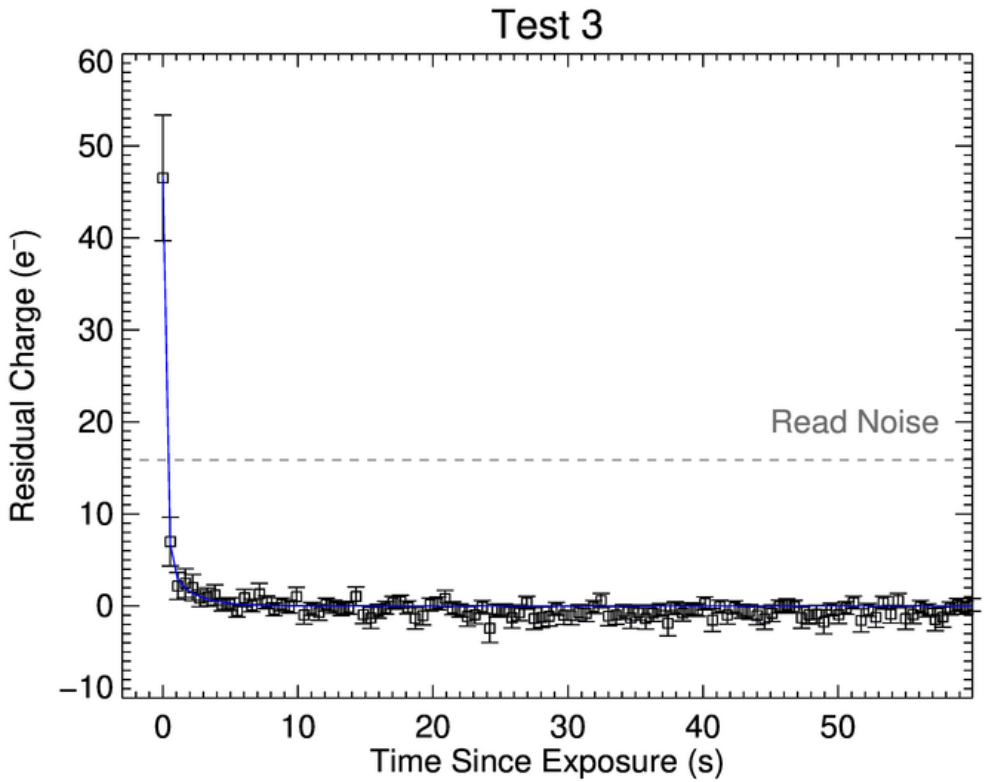


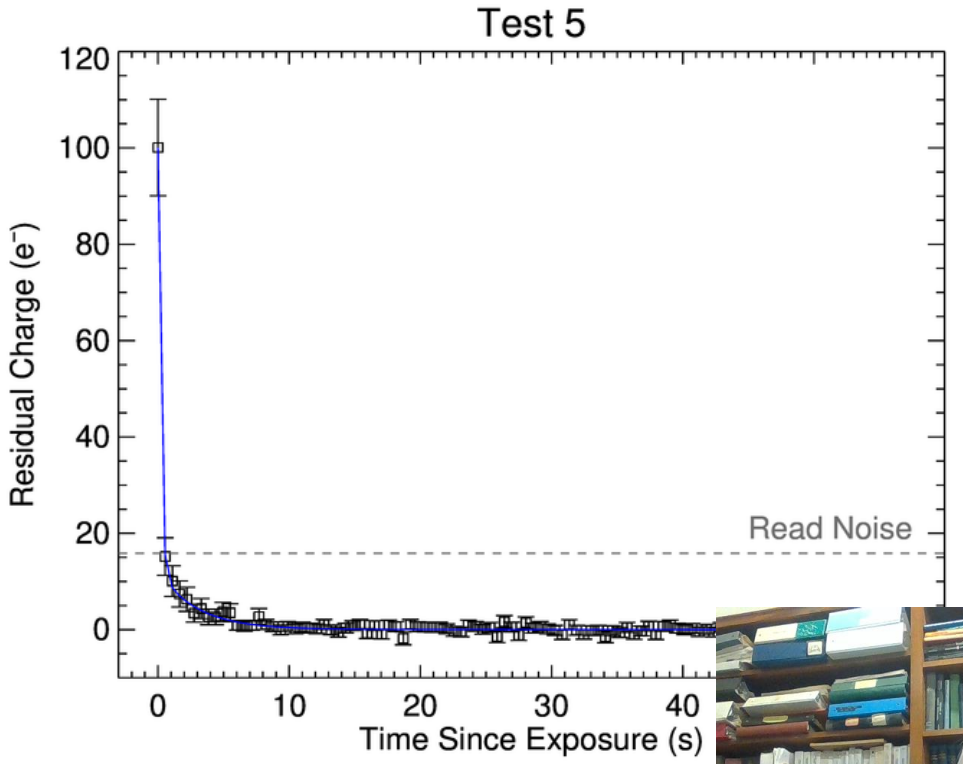
Detailed Characterization



- Image quality defined by MTF – modulation transfer function and “brighter-fatter” effects (broadening of point source response as function of signal level)
  - Both measured in our lab
- Temperature fluctuation stability demonstrated
  - Fast and slow fluctuations +/-50mK

Residual Image tests (left – unsaturated; right - saturated) – rapid decay in both cases





Decay fit by $S=A\exp(-\tau 1)+B\exp(-\tau 2)$

For further detail

Please read full paper uploaded to the same website containing this e-lightning presentation.

Thank you.