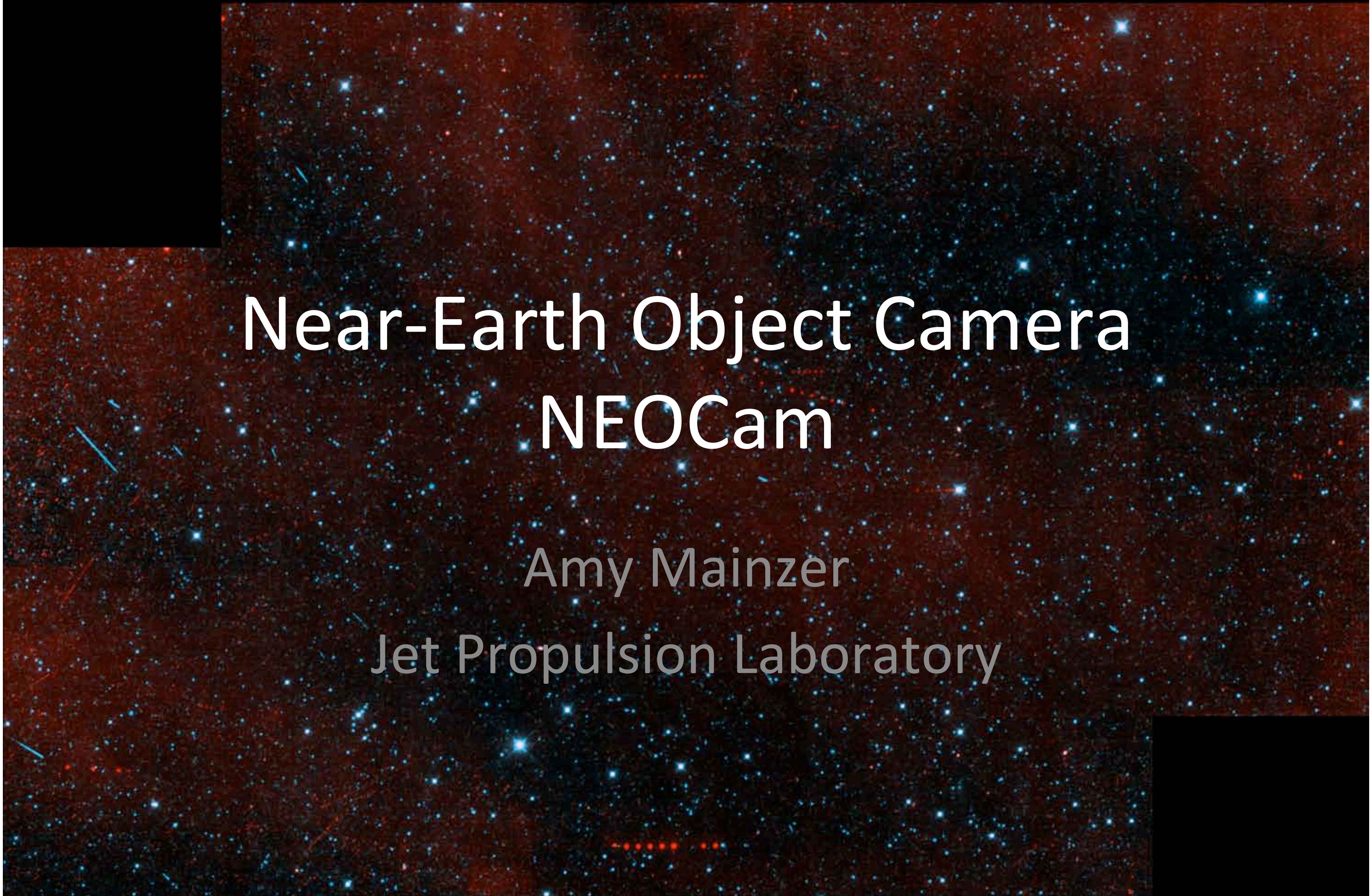
Near-Earth Object Camera
NEOCam



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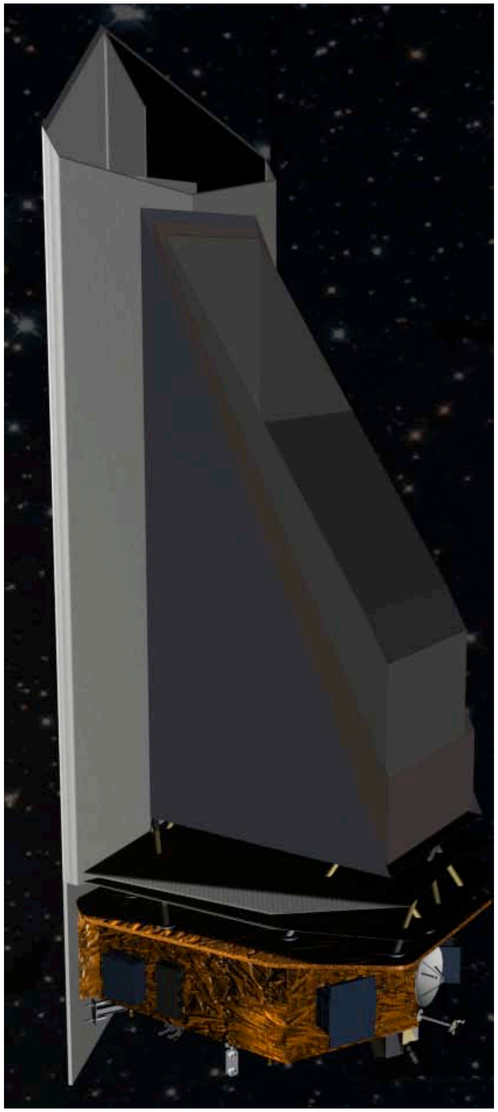
Near-Earth Object Camera (NEOCam)

- Discovery proposal submitted in 2006, 2010
  - Awarded technology development in 2010
- Wide-field imager operating at 2 wavelengths: 4-5 & 6-10 μm
- 4 year mission to discover & characterize 2/3 of near-Earth objects (NEOs) >140 m, lots of Main Belt asteroids, comets
- NEOCam's primary science objectives are threefold:
  - To assess the present-day risk of near-Earth object (NEO) impact.
  - To study the origin and ultimate fate of our solar system's asteroids.
  - To find the most suitable NEO targets for future exploration by robots and humans.



Heritage

- WISE/NEOWISE, Spitzer, Kepler
  - WISE/Spitzer instrument heritage
  - Spitzer passive cooling
  - WISE/NEOWISE data processing
  - Kepler spacecraft bus
- Partners: JPL, Ball Aerospace, Space Dynamics Lab, Teledyne Imaging Sensors, IPAC
  - Competed selection of partners managed by small team at JPL
  - Science team includes experts in small bodies, IR telescopes, detectors

NEOWISE

- Wide-field Infrared Survey Explorer (WISE) imaged entire sky in 4 IR wavelengths over 1 year mission
  - Partners: JPL, SDL, Ball, IPAC, Teledyne, DRS

- NEOWISE augmentation allowed detection & discovery of new minor planets
  - >158,000 asteroids detected; ~34,000 new discoveries
  - ~600 NEOs observed, 135 new discoveries
  - Physical parameters determined: diameters, albedos, dust properties, etc.
  - Albedo-insensitive survey detects bright and dark asteroids equally well

2011 GAO Report

Table 3: Cost Growth from Confirmation for Selected Major NASA Projects That Established Baselines Prior to Fiscal Year 2009 (dollars in millions)

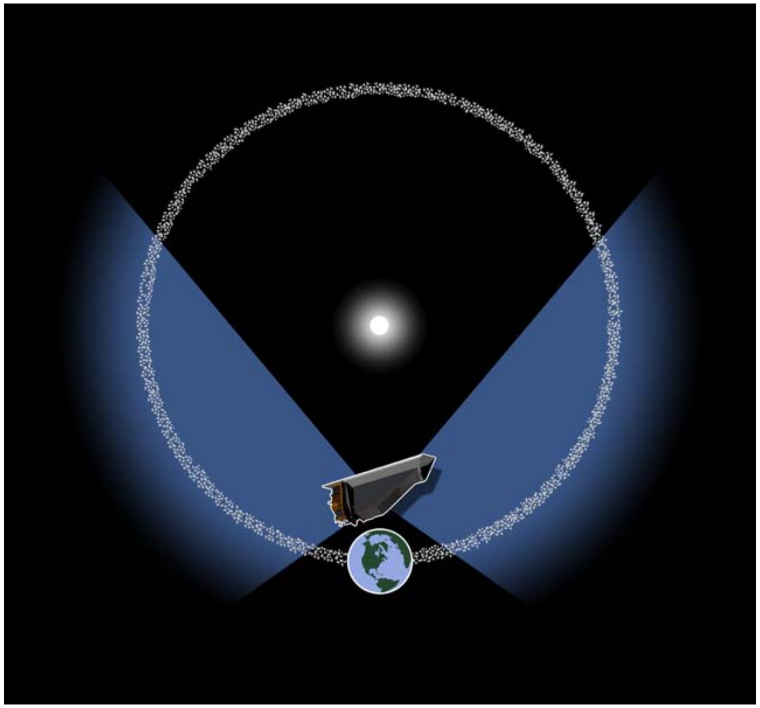
Project	Development cost			
	Baseline	Current	Difference	Change (%)
Aquarius	$193.0	$227.3	$34.3	17.8
Dawn	$198.0	$266.4	$68.4	34.5
GLAST	$384.0	$418.8	$34.8	9.1
Glory	$159.0	$337.6	$178.6	112.3
Herschel	$95.0	$126.7	$31.7	33.4
Kepler	$313.0	$388.7	$75.7	24.2
LRO	$421.0	$451.3	$30.3	7.2
MSL	$969.0	$1,802.0	$833.0	86.0
NPP	$513.0	$780.1	$267.1	52.1
OCO	$187.0	$230.2	$43.2	23.1
SDO	$597.0	$667.0	$70.0	11.7
SOFIA	$306.0	$1,128.4	$822.4	268.8
WISE	$192.0	$191.8	-$0.2	-0.1
Average			**$191.5**	**54.99**
Total development cost	**$4,527.0**	**$7,016.3**	**$2,489.3**	

Source: GAO analysis of NASA data.

Note: "Baseline" refers to the cost baseline established when the project was confirmed.

Orbit – Why L1

- Earth-Sun L1 Lagrange point allows large fraction of Earth's orbit to be visible at any time
- Cold environment allows passive cooling c.f. Spitzer Warm Mission
- Constant close distance (~1e6 km) allows full-frame data to be downlinked, leveraging WISE/ NEOWISE science data processing heritage
- L1 orbit has heritage from SOHO, Genesis



Detectors

- Teledyne Imaging Sensors HAWAII 1RG and 2RG HgCdTe detectors selected for NEOCam

- HAWAII chips are low background multiplexers used for a wide range of astronomical purposes, ground- & space-based

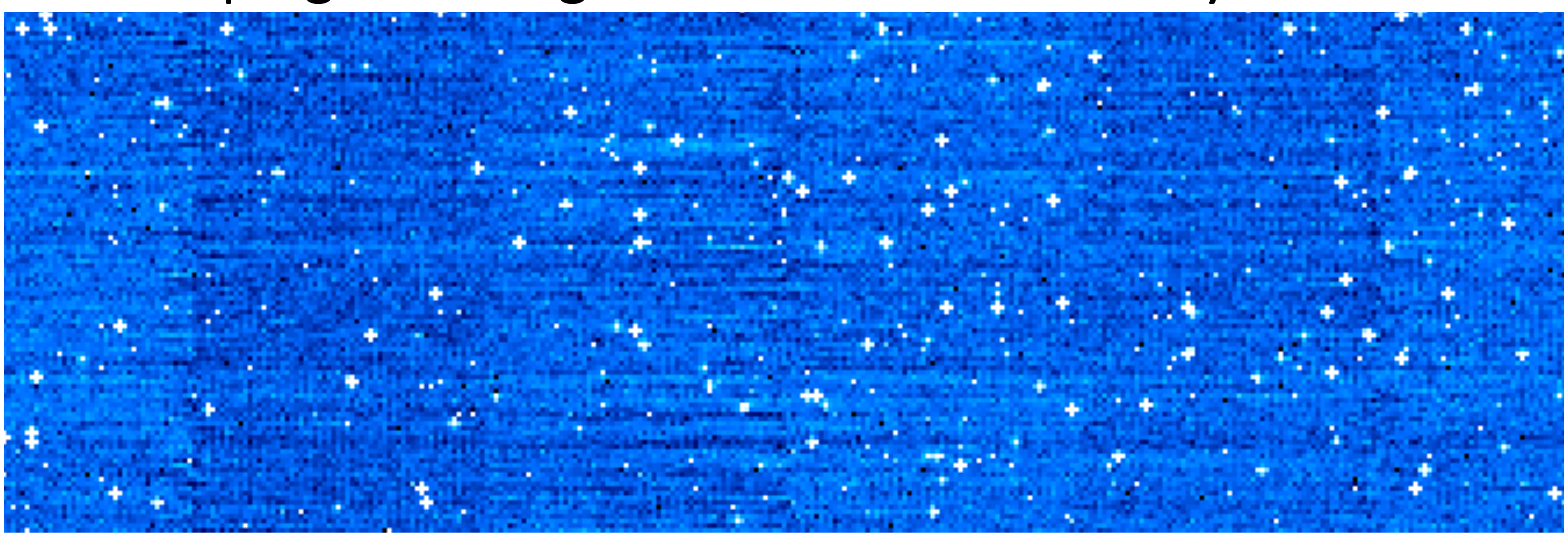
- Space astronomy heritage: WISE, Hubble WF3, OCO-2, JWST

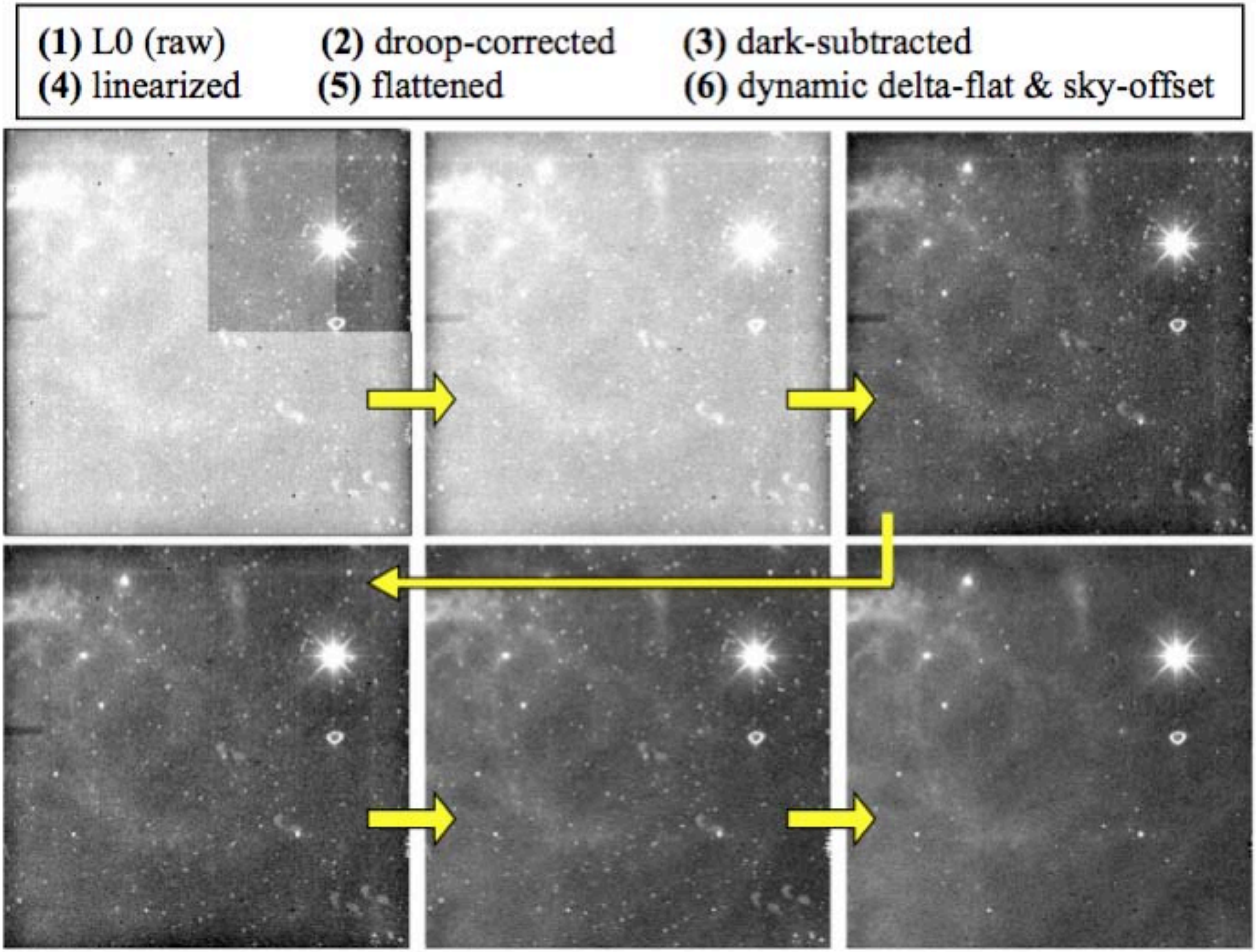
- SIDECAR ASIC allows cryogenic A/D conversion, commanding, signal processing, eliminating analog elex & cables

- We are fabbing & testing new lots of detectors, funded by NASA Discovery
  - 5 μm cutoff arrays are TIS standard product
  - 10 μm cutoff material is created by altering Hg:Cd ratio, bonded to HAWAII 1RG WISE/OCO mux

Science Data Processing

- Location @ L1 allows full-frame data to be downlinked
  - Leverages existing science data processing pipeline & archive heritage from WISE/NEOWISE
- When discovering new objects, most are found at low SNR
- Success at detecting sources & linking into tracklets depends on accurate artifact ID, astrometric & photometric calibration
- Developing & testing NEOCam cadence via synthetic survey




(1) L0 (raw)
(2) droop-corrected
(3) dark-subtracted
(4) linearized
(5) flattened
(6) dynamic delta-flat & sky-offset


Thank you!
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