Synoptic All-Sky Infrared (SASIR) Survey

♦ Camera & Detectors ♦







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Josh Bloom (UC Berkeley) <u>http://sasir.org</u> <u>http://www.inaoep.mx/~progharo/gh2008/</u>

SASIR/Guillermo Haro Workshop; 13 Aug - 21 Aug

Camera Design

• plate scale, nominally driven by site seeing $\Rightarrow Nyquist sampling suggests$ 0.15" - 0.2" pix • detector pitch (15 - 20 micron) + primary aperature ✓ f ratio (2 - 3) • science drivers + cost drive FOV \Leftrightarrow nominally 0.8 deg

diameter







IR Detectors

removal of CdZnTe substrate gives sensitivity to 400 nm (improves yield)



VISTA: 16x Raytheon VIRGO 2k x 2k



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2K SCA's Mounted on Modules for Minimum Edge Gaps

Top View

Back View

Mounting Holes

41

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Sensor Chip Assembl y (SCA) Wirebonds to Motherboard

Pedestal

1 inch

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Cable and Connector Wirebond to back of motherboard 03 10

9 Modules in Thermal Isolating Housing

- Provides Convenient Mounting of Modules
- Provides accurate alignment
- Inner cold structure insulated from outer housing for minimum headload
- Design space qualified



WIRCAM/CFHT: 4x H2RG Teledyne

also, WFC3, WIRE, MOSFIRE, JWST, SNAP



Hawaii-2 RG

18 μm pixels = 0.228"/pix (@ f/2.5) = 0.163"/pix (@ f/3.5)

2040 x 2040 live pixels

fill factor = 0.757



Hawaii-2 RG

sidecar electronics feed cabling under array

32 channel read-out 500,000 pix/ sec

"rolling shutter"



nominal correlated double sampling for SASIR: reset - dither - reset - read1 - int (60 sec) - read2

Hawaii-2 RG

- •100,000 e "full-well" (95% linearity)
- •< 30 e readnoise (CDS)
- 16 bit A/D (+ 12 bit A/D for fast reads)
- 1 of 32 channels can be used for fast reads of subarrays during exposure -> on-chip guiding! cf. WIRCAM/CFHT

Heat load:

1/2 Watt per ASIC at running at capacity x 80 ~ 40 Watt * 5% duty cycle ~ <2 Watt>

Basic Costs

science grade

1x 2k x 2k array = \$350,000 (H2RG; Teledyne)= \$380,000 (VIRGO: Raytheon)

(Teledyne) $\begin{cases} + \$25k \text{ readout circuit} \\ + \$42k \text{ sidecar ASIC kit} \\ (USB \text{ interface}) \end{cases}$

Yield is key to cost & time: we "buy the distribution"
e.g., engineering grade H2RG = \$50k

Distribution of quality is an advantage

- e.g. we can tolerate higher readnoise/dark in K-band
- but drives multi-filter focal plane



wavelength

Overall Costs & Timeline

distribution discount: avg. ~\$200k/unit (including sidecar, electronics...)

~(\$16M to \$24M) + \$2M focal plane assembly ~ \$18M - \$26M (5 - 8 cent/pixel)

3 - 4 yr timescale for delivery is ok with milestone payments beginning ~start of 2009

Nominal Plan

- Continue discussions with both Raytheon & Teledyne
- Tour of both facilities (~this fall)
- Procure one 2k x 2k array (loaner from SNAP?) to built test camera?
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Teledyne NSF grant for 4k x 4k 15 micron pixel pending (April?)

we could "kick start" production with upfront payment (in concert with TMT?)

Advantages:

2 - 3 cents/pixel (factor of 2 savings) much more filled area