The Astrometric Promise of Large A*Ω

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Executive Summary

Is anything left to do?

- *Gaia* and *SIM* promise to do everything:
  - Microarcsecond astrometry down to 20th.
  - Sub-microarcsecond astrometry for planets.
  - Francois Mignard is a tough act to follow.

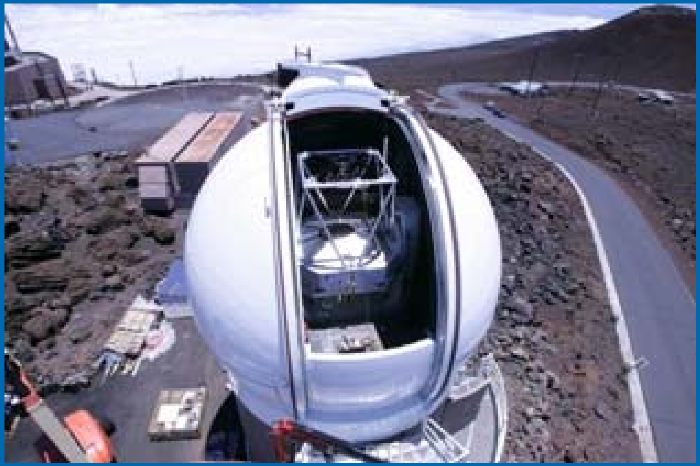
Ground vs. Space

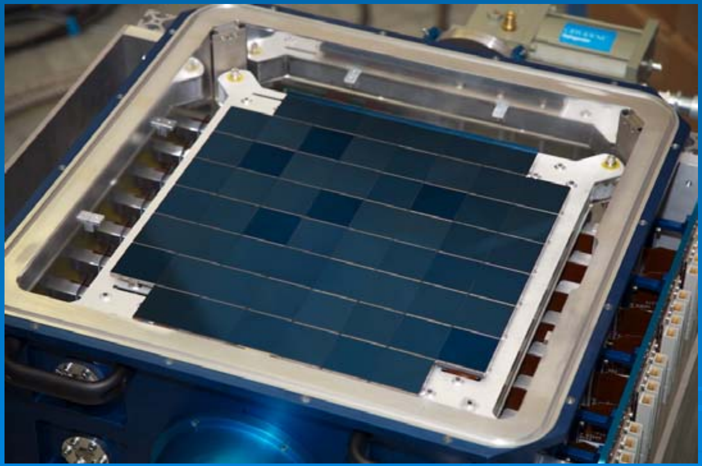
- Reasons to go to space:
  - Ultimate in astrometric accuracy.
  - Big teams of clever folks.
  - Lots of money and glamour.
- Reasons to stay on the ground:
  - Useful astrometric accuracy.
  - Big apertures.
  - High data rates.
  - Long duration missions.

A*Ω Astrometry

- A*Ω is etendue ($meter^2$ $degree^2$):
  - Metric for telescope efficiency - sort of.
  - New optical designs deliver large useful fields.
  - New CCD mosaics offer many 10^8 to 10^9 pixels.
  - Parallel electronics to read in a few seconds.
- 4 projects are in construction or planning:
  - Pan-STARRS (U. Hawaii + USAF).
  - SkyMapper (Australian National University).
  - SST (DARPA + MIT/LL + USAF).
  - LSST (LSST Corporation).
- Astrometric utility of any/all of these systems?
  - Several visits to all available sky - per lunation!
  - Astrometry for all 10**9 (or maybe 10**10) objects.
  - No selection effect other than photons.
- Photography enabled motion - A*Ω enables parallax.

Pan-STARRS - PS1



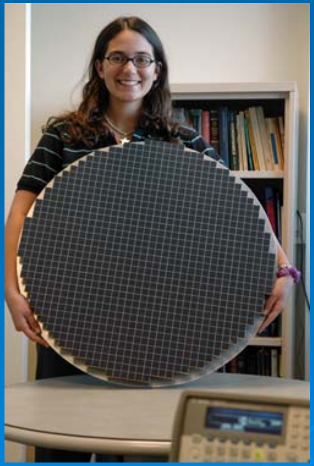


- On Haleakala (Maui).
- First light: Aug 2007.
- ORR: Dec 2008.
- 3π survey: 15 visits in a total of 6 colors from δ=-30 to δ=+90.
- 1.8-m aperture.
- 1.4 billion pixel camera.
- PS-2, PS-4.

SkyMapper

- Siding Springs (Australia)
- First Light: Sep 2008?
- 6 visits in each of 6 colors from δ=-90 to δ=0.
- 1.3-m aperture.
- 256 million pixel camera.

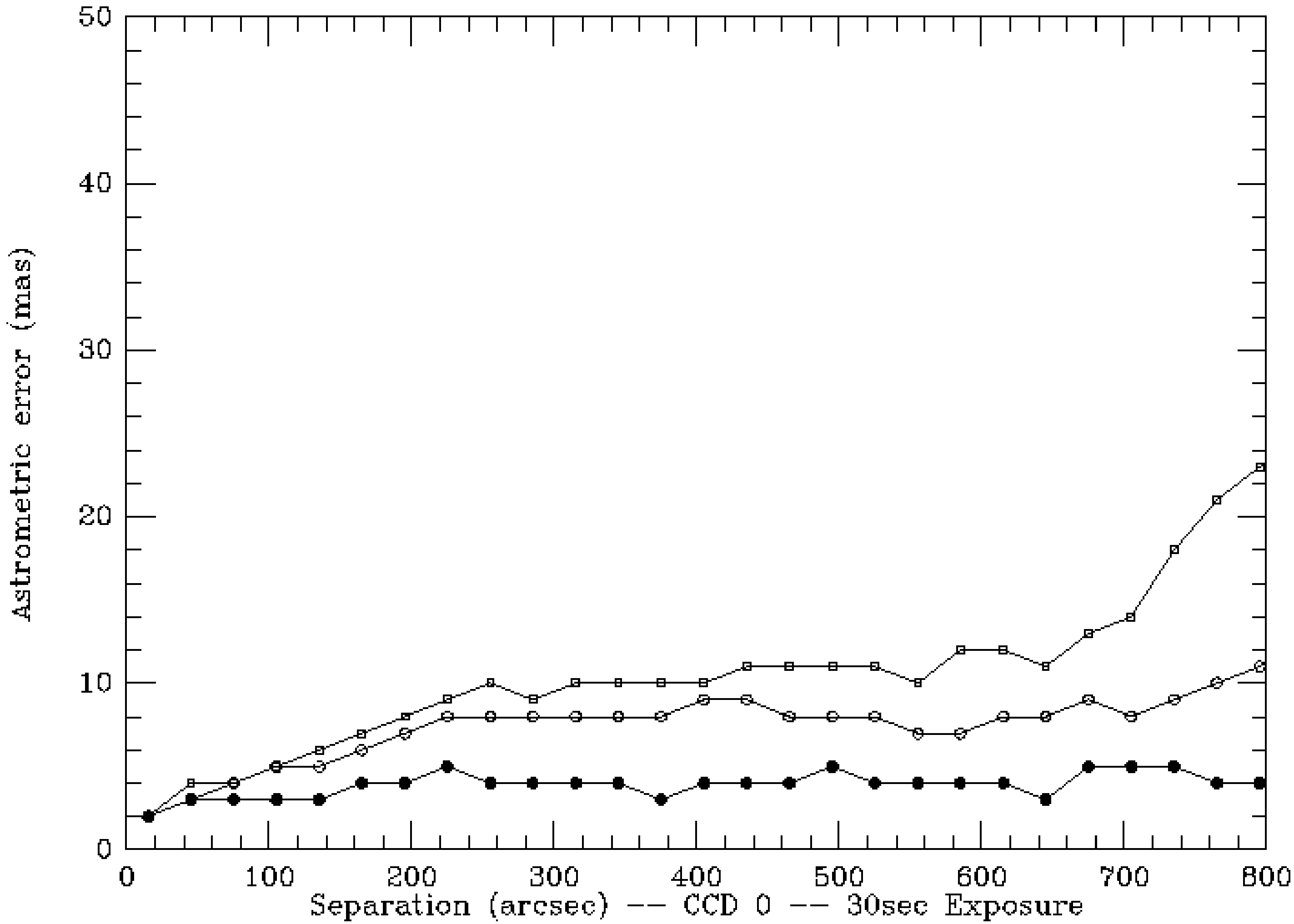
LSST



- Cerro Pachon (Chile).
- First Light: 2014?
- $50M raised already.
- 3 visits of entire visible sky every lunation.
- 8.4-m aperture.
- 3.4 billion pixel camera.

Astrometric Utility?

- Not much legacy for huge field, short exposure astrometry.
- Data from *Subaru*, *Gemini*, *SOAR*, others.
- My expectation:
  - 10 milliarcseconds per star per visit - differential.
  - Limited by photons or seeing.
  - Differential chromatic refraction is big issue.
  - Solve sky chunk at a time - messy.
  - Not sure about trying to solve for the sphere:
    - Why bother when *Gaia* will do this for us, much better.
  - Faint - correction from relative to absolute is small.
- Real data starting to appear right now!

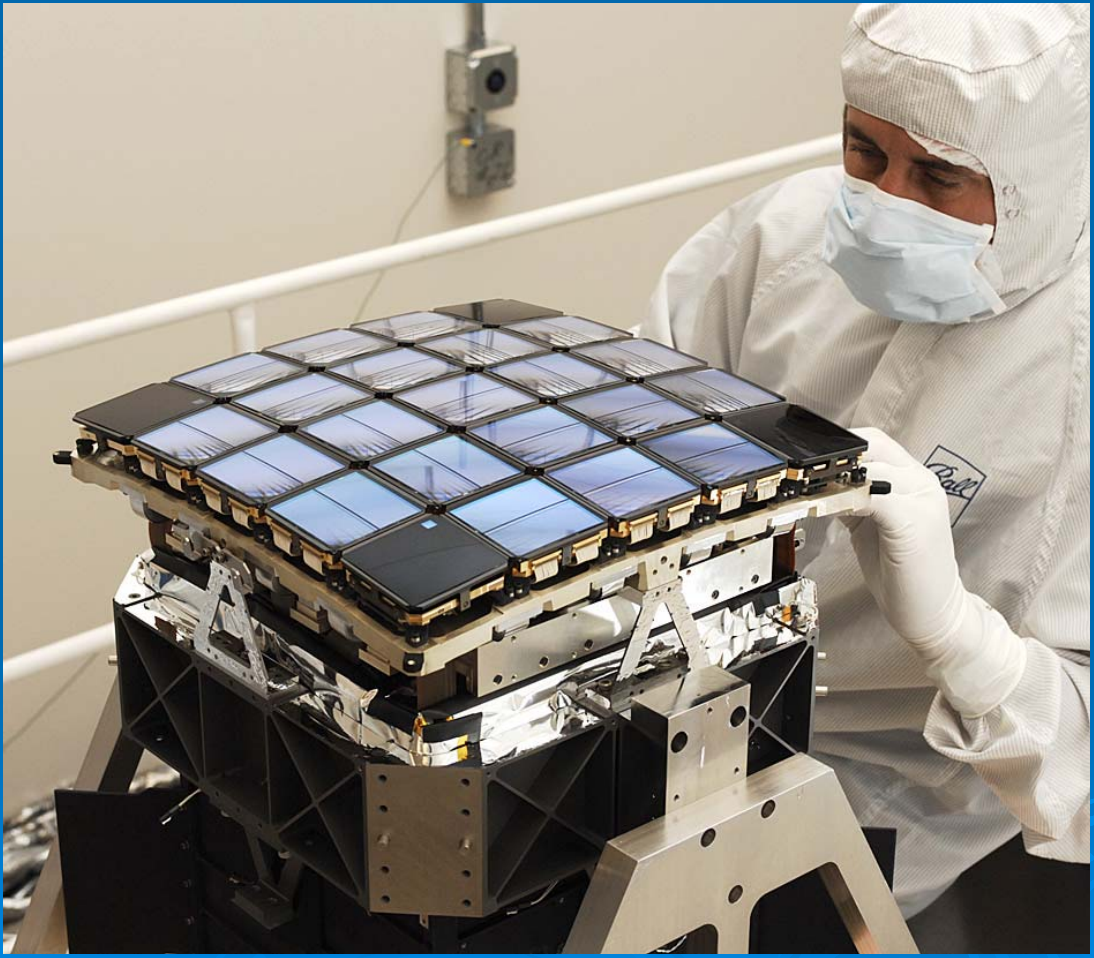


50
40
30
20
10
0
Astrometric error (mas)
0
100
200
300
400
500
600
700
800
Separation (arcsec) -- CCD 0 -- 30sec Exposure

Summary

- Astrometry at 10 Tbytes/night is fun!
  - Starting now!
- Expect milliarcsecond results before *Gaia*.
- LSST will go much fainter than *Gaia*.
  - Astrometry at r = 26?
- Synergy between ground and space.

Kepler Astrometry - SNR→∞



Say Hello to the new
iPhone ATM
• All the functionality of the original iPhone™
• Unlimited local and long distance calls at no charge
• No bank account necessary
• Unlimited withdrawals
• Genuine U.S. currency with unique serial numbers
• Never needs recharging, batteries, ink, or paper
• Unlimited iTunes Music Store™ downloads at no additional cost
Welcome to the iPhone ATM
$100
$500
$1000
Other
iPhone ATM.
A guided tour.
Watch video
iPhone ATM
keyboard.
Watch video
Where to buy.
Worth1000.com