

**Understanding the Atmospheres of Hot Earths and
the Impact on Solar System Formation**

Observations Discussion



Progress so far

- 1) About 8 nights of data
- 2) Eight targets observed (?)
- 3) Four nights with GTCam2 (?)
- 4) Three nights with RS1340(?)

Progress so far

Amanda has processed several nights of images.

Different processing strategies need to be examined (MOMF -vs- aperture)

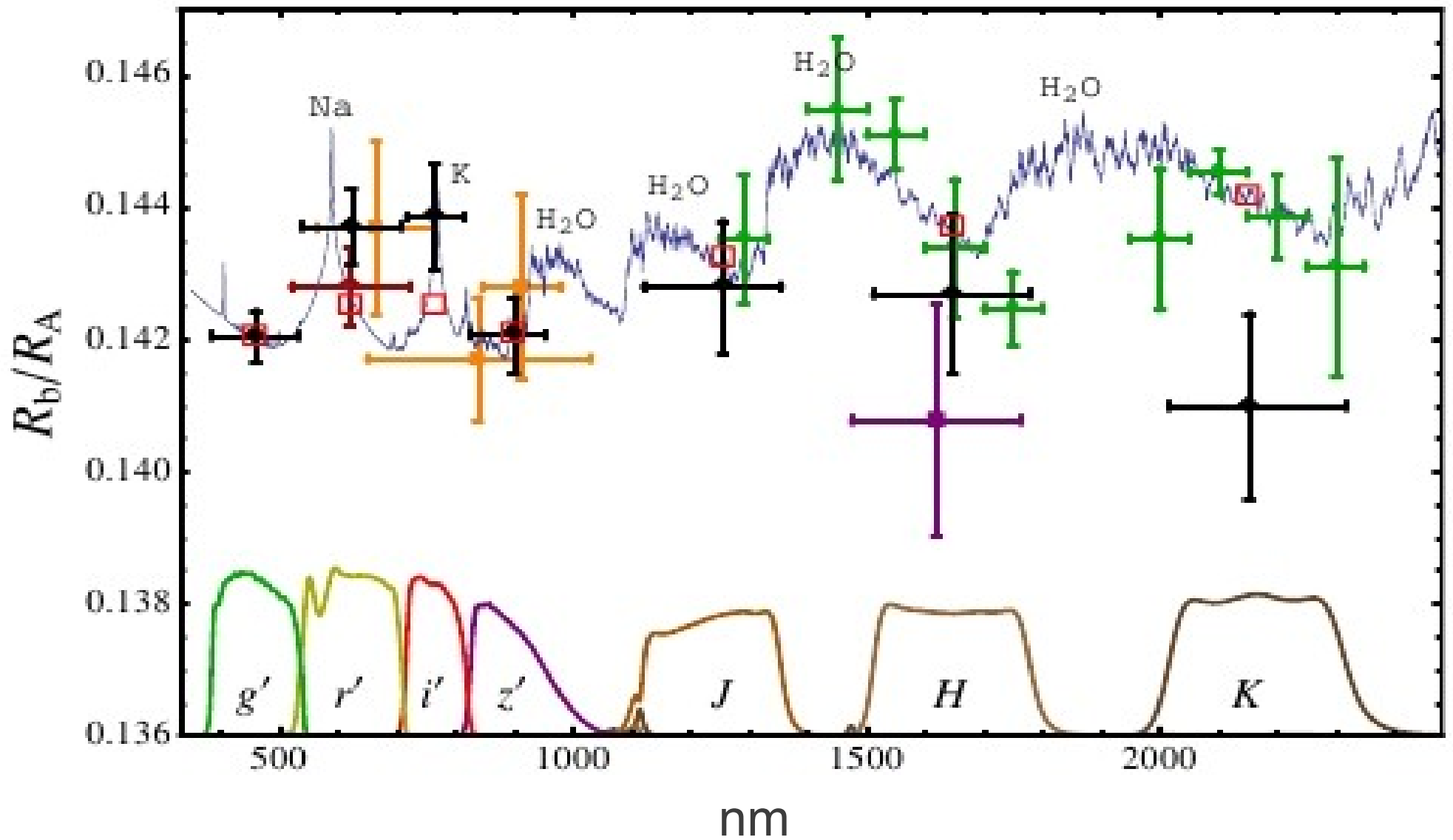
Using Baker Observatory 16" scope only.

KPNO 2 meter application rejected.

Outline:

- 1) Available facilities
- 2) What wavebands are likely to be important
- 3) What precision will be required?
- 4) Anything to discuss.

Filter Reminder



Telescopes

- 1) KPNO 2 meter
- 2) KPNO 4 meter
- 3) Gemini North and South (8 meter)
- 4) Keck (10 nights shared time)
- 5) AAT (3.9m 10 nights shared time)
- 6) WIYN 3.5m
- 7) IRTF?
- 8) Spitzer?
- 9) Sofia?
- 10) CFHT (3.6m)? (WIRCam

KPNO Instruments

- 1) Newfirm (4m): IR Imager: 28' square FoV
- 2) Phoenix (4m, 2.1m) IR spectrograph (1-5 microns) $50K < R < 70K$ Echelle spectrograph
- 3) FLMN: IR Imager/spectrograph
- 4) CCD Imagers

WIYN (3.5m) Instruments

1) WHIRC: High-Res IR Camera
3.3x3.3' FoV with J,H,K_s filters and
some narrow-band filters.

Gemini (8m) Instruments

- 1) NIRI- Near IR imager
- 2) GNIRS- Near IR spectrograph
- 3) GMOS- Optical Imager
- 4) Flamingos-2: Near IR imager and spectrometer.

AAT (3.9m) Instruments

1) IRIS2- n-IR imager/spectrograph

SOAR (4m) Instruments

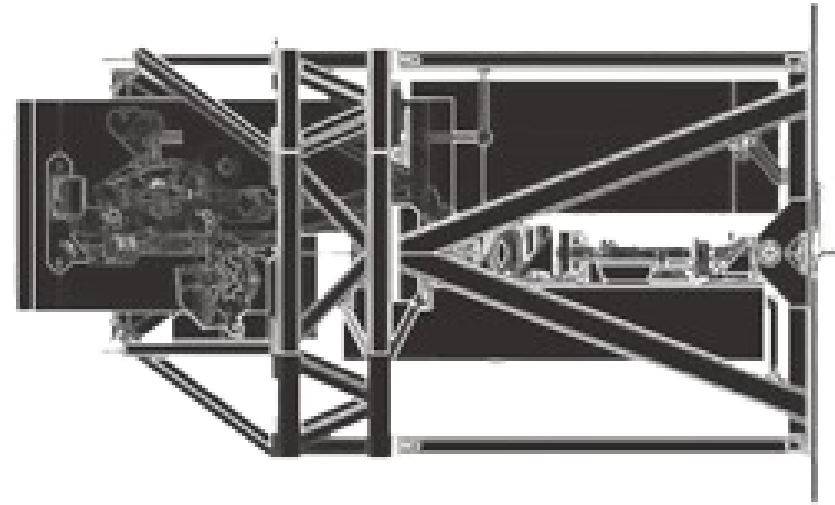
- 1) OSIRIS- IR imager/spectrometer
- 2) SOI- Optical imager
- 3) Spartan- IR imager

CTIO 1.3m (SMARTS?) Instruments

1) ANDI_CC DIR- IR Imager

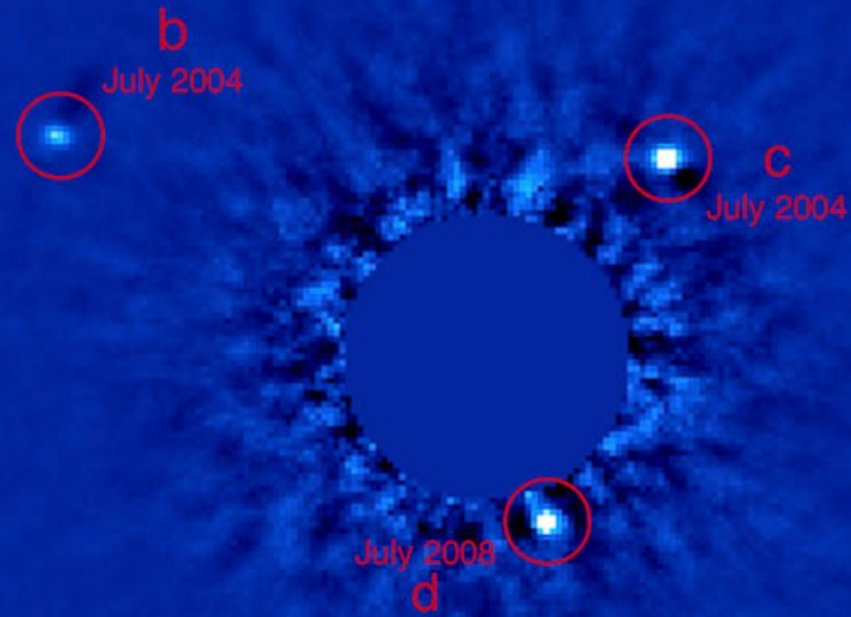
Upcoming Instrumentation

Gemini Planet Imager AO system



Public access telescope (GPI may be dedicated for this team) from 0.9-2.4 microns.
0.2-1" separations: made to examine Jupiters at 5-40 AU from their parent star.
Spectroscopy.

All bigger than Jupiter



0.5 arcsec
20 AU

WIRC at Hale (200" scope)

9x9' FoV on 2Kx2K detector
Filters are J,H,K_s as well as
some narrow-band and
methane-specific IR filters.
It is a prime focus camera.
1 second dead time(?)

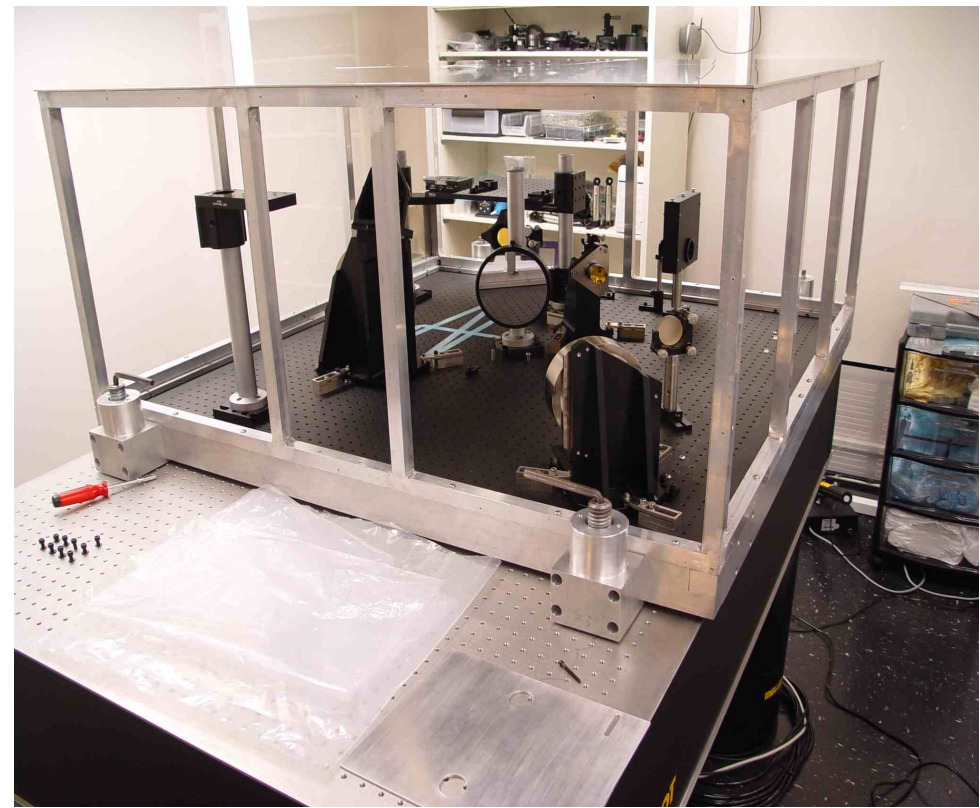
Public time not available (maybe some
small amount-I'm not sure).



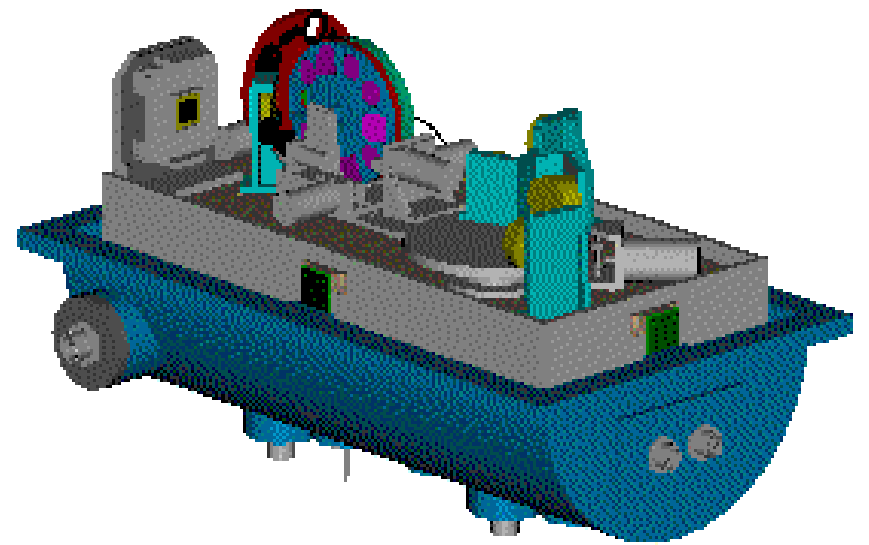
Project 1640: A coronagraph with IR imager.

In 'private' mode at
Palomar and AEOS (Air
Force telescope).

Uses AO and a coronagraph to cancel
starlight down to 0.2" (close enough?).



PHARO
High Angular Resolution
IR (J,H,K) camera for
Palomar
24 & 40" FoVs
Uses AO too.



What waveband will be
important

and

What precision will be
required?

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Modeling required- ACME stellar spectra database may help.

IRTF Spectral Library

Need a model!

Observing Issues

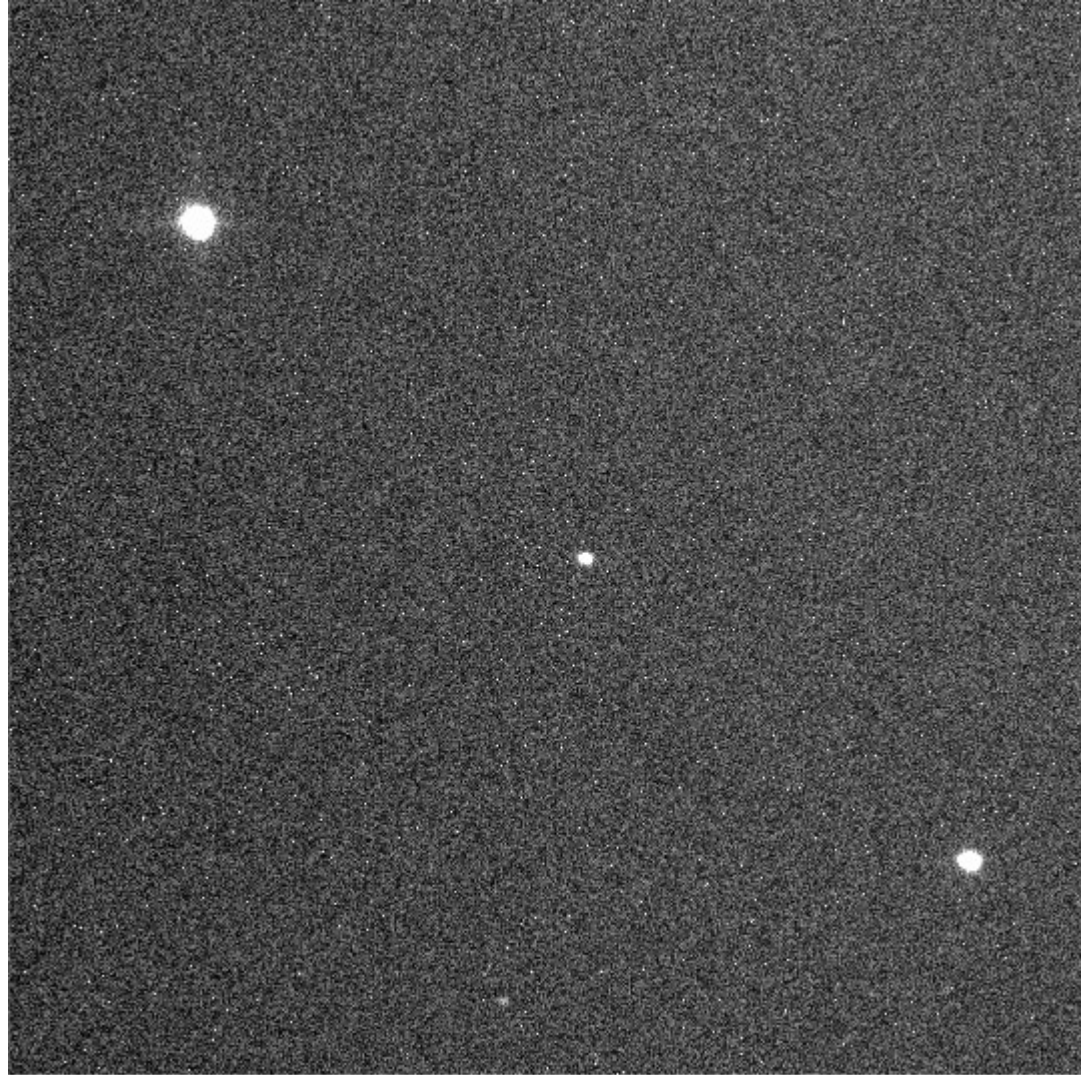
Night-to-night calibration-
differential extinction

Flux standard stars

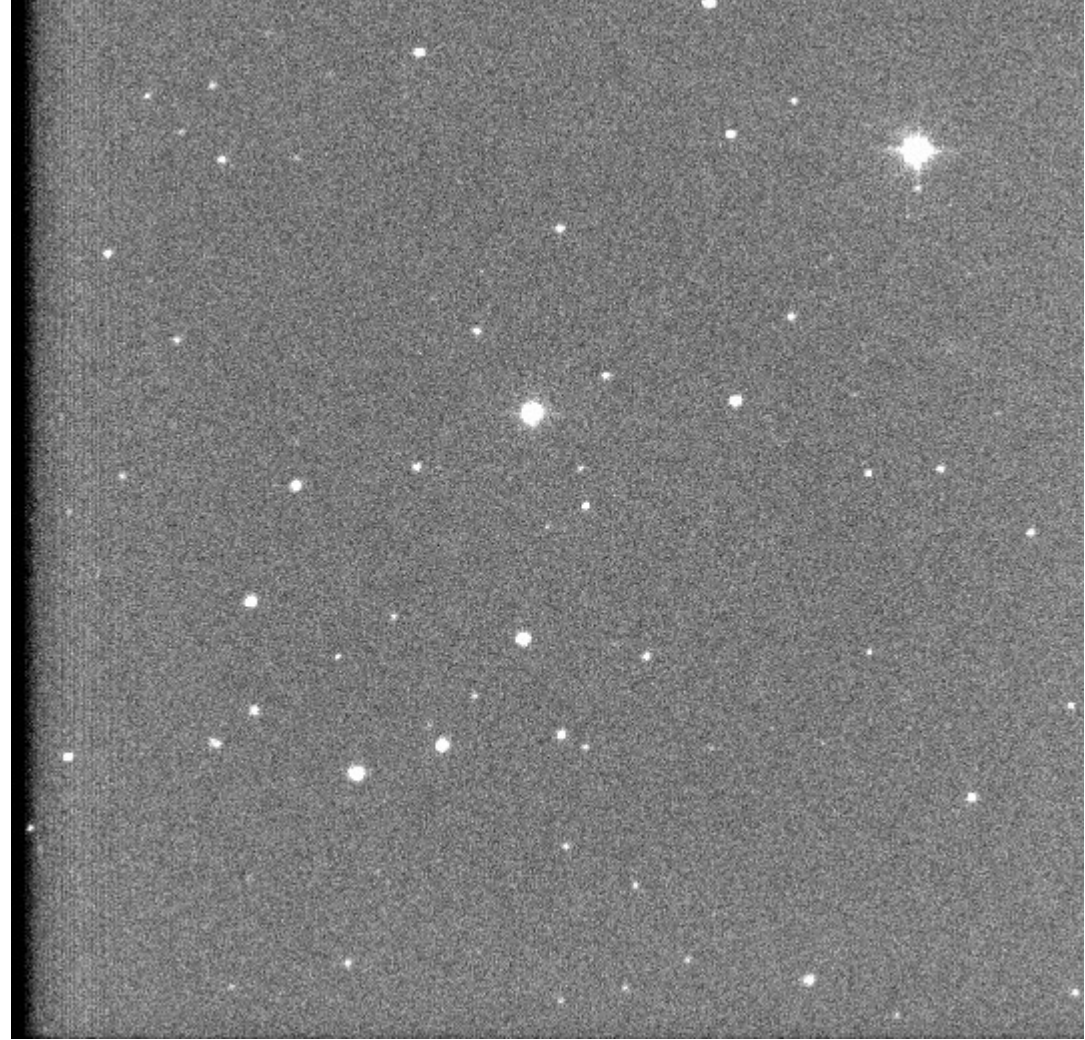
What precision will be
required?

<100 ppm for transiting
superEarths.

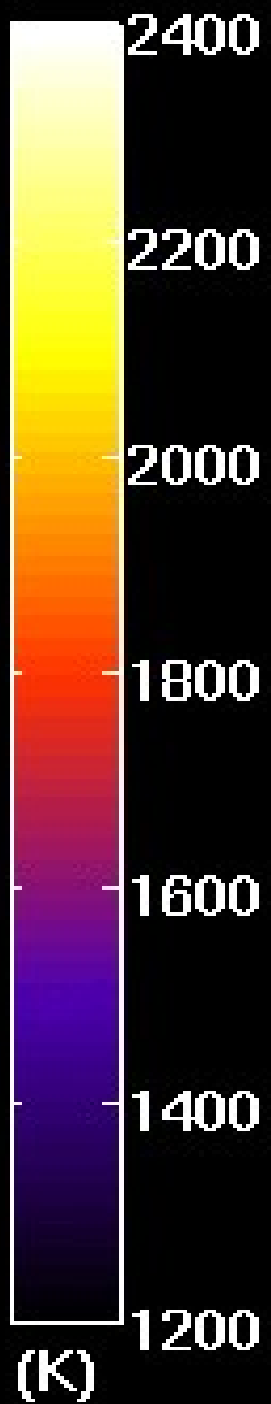
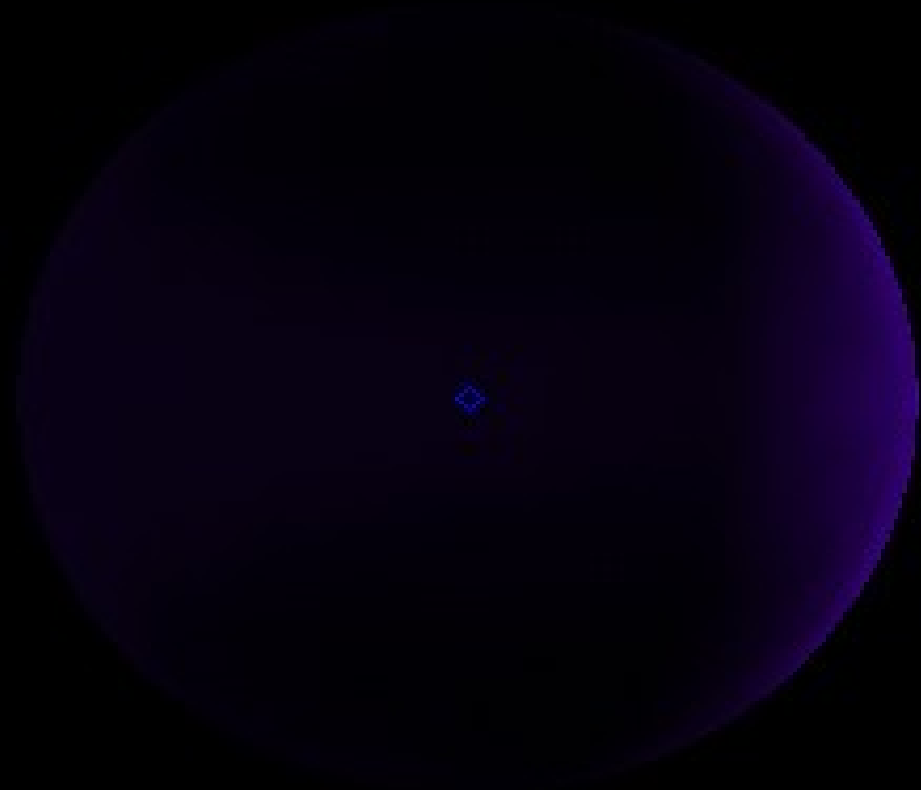
IR camera for
GTCam2?



Beamsplitter on filter
box for RS1340 + IR
cam?



Other stuff?



(K)

Tackley et al. Icarus 2013: All super-Earths have plate tectonics based on mantles being super-adiabatic and isoviscous.

Valencia et al.: Bulk compositions of sub-Neptunes: indicates $<10\%$ H/He by mass. (Kep11b,c,d,f; Kep18b; Kep20b; 55Cnc e; Kep36c; Kep68b; Kep30b) using models.

Kurokawa & Kaltenegger 2013: Atmospheric mass loss during migration: CoRoT-7b and Kepler 10b

Gong & Zhou 2012RAA; Wagner et al. 2012A&A: Si & C & Fe models of CoRoT-7b, Kep9d, Kep10d