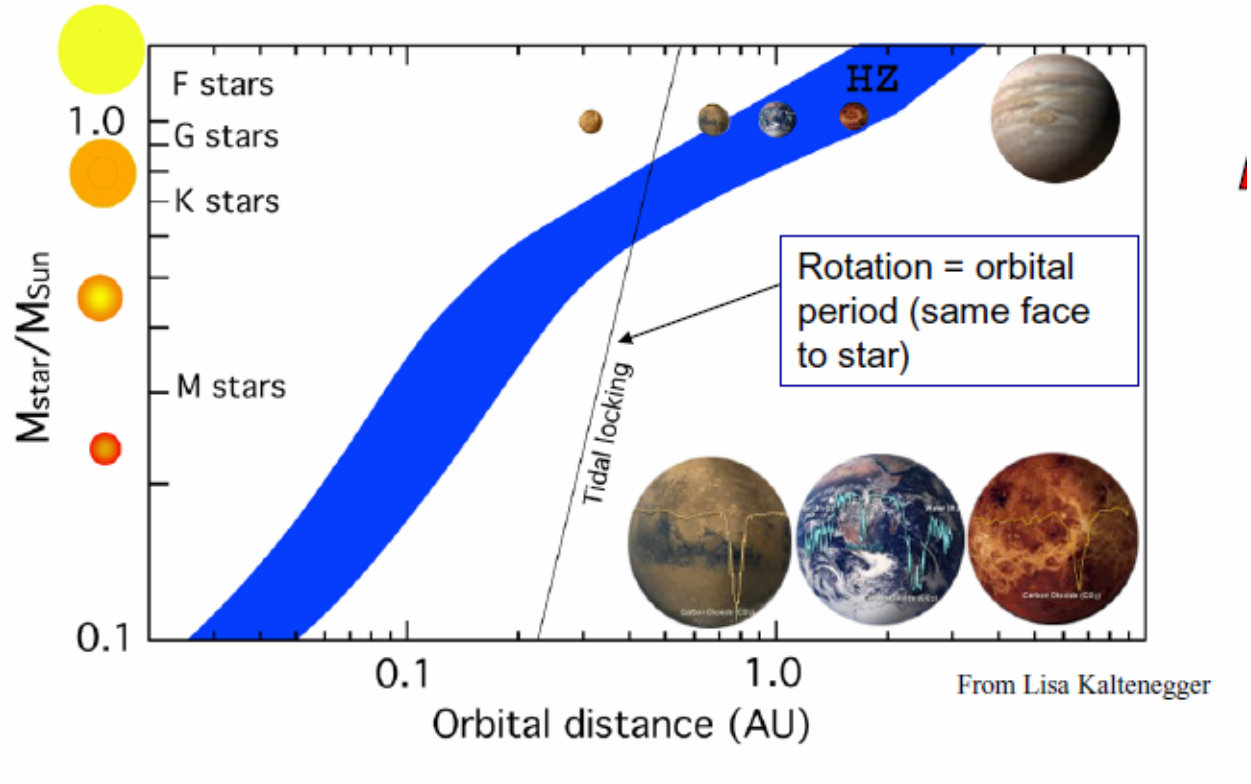
Major exoplanet questions to be addressed in the next decade, identified by ExoPTF committee for the US decadal survey in 2008

1. What are the physical characteristics of planets in the habitable zones around bright, nearby stars?

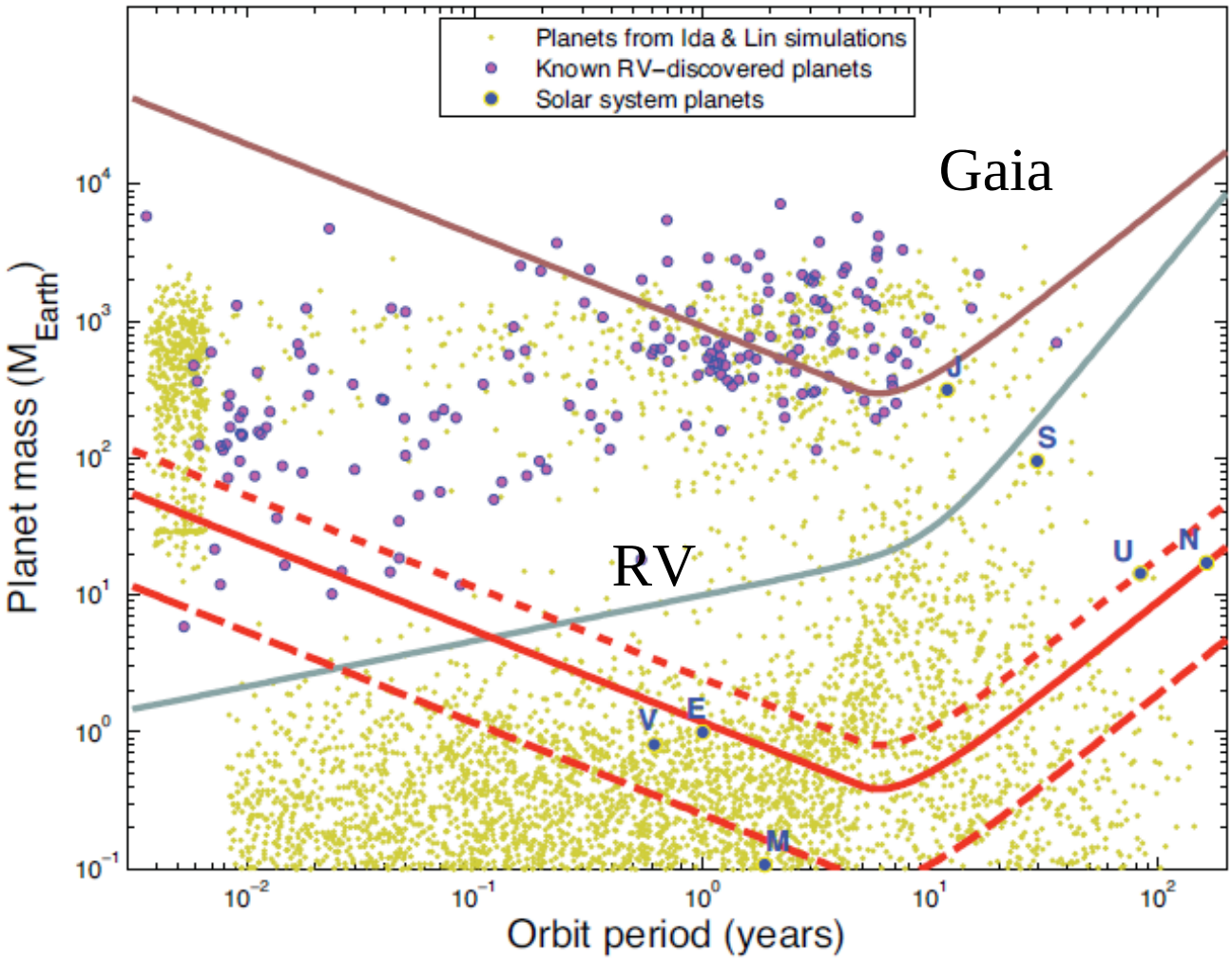
2. What is the architecture of planetary systems?

3. When, how and in what environments are planets formed?



Astrometry

•Space Interferometry Mission (SIM) and Gaia

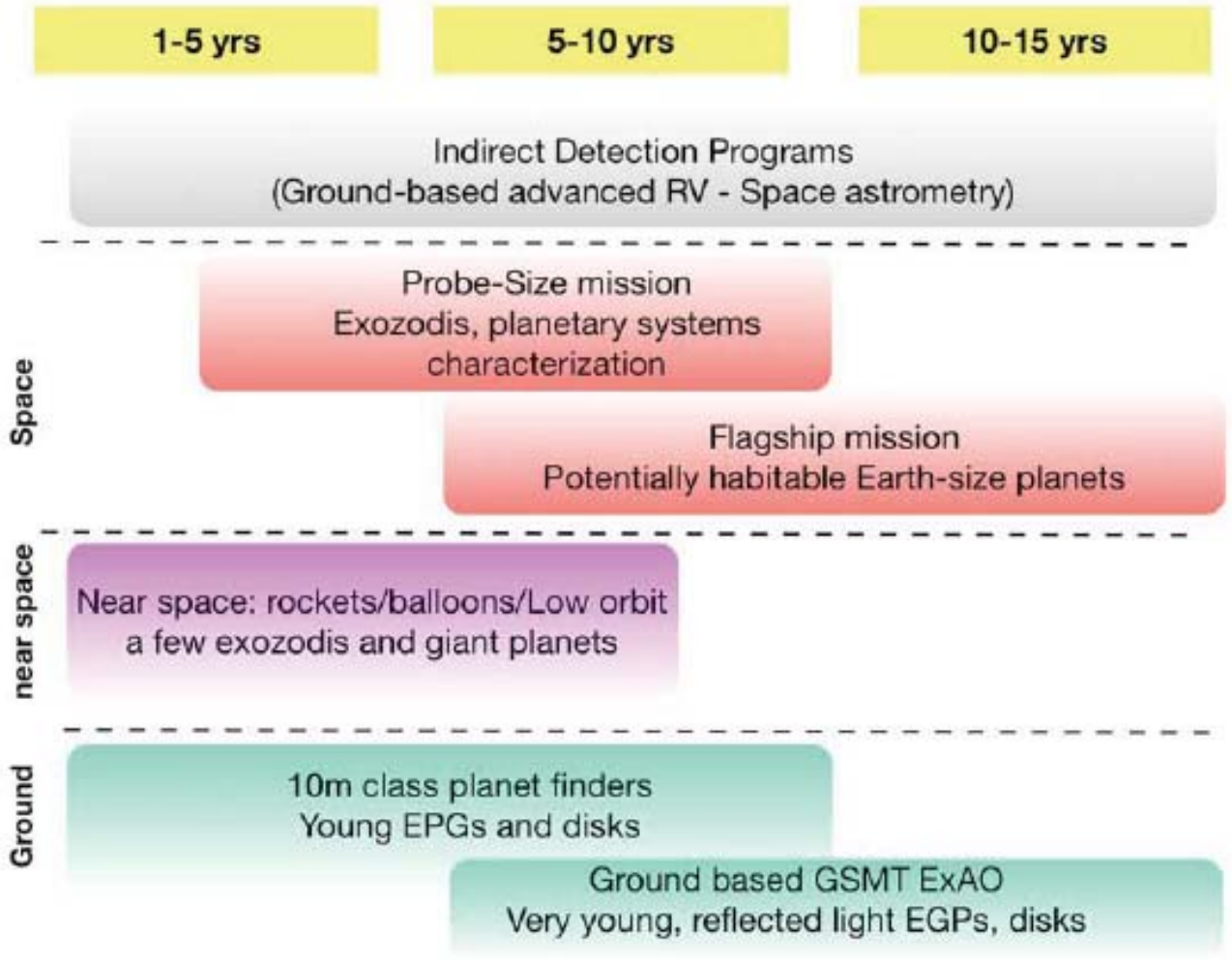


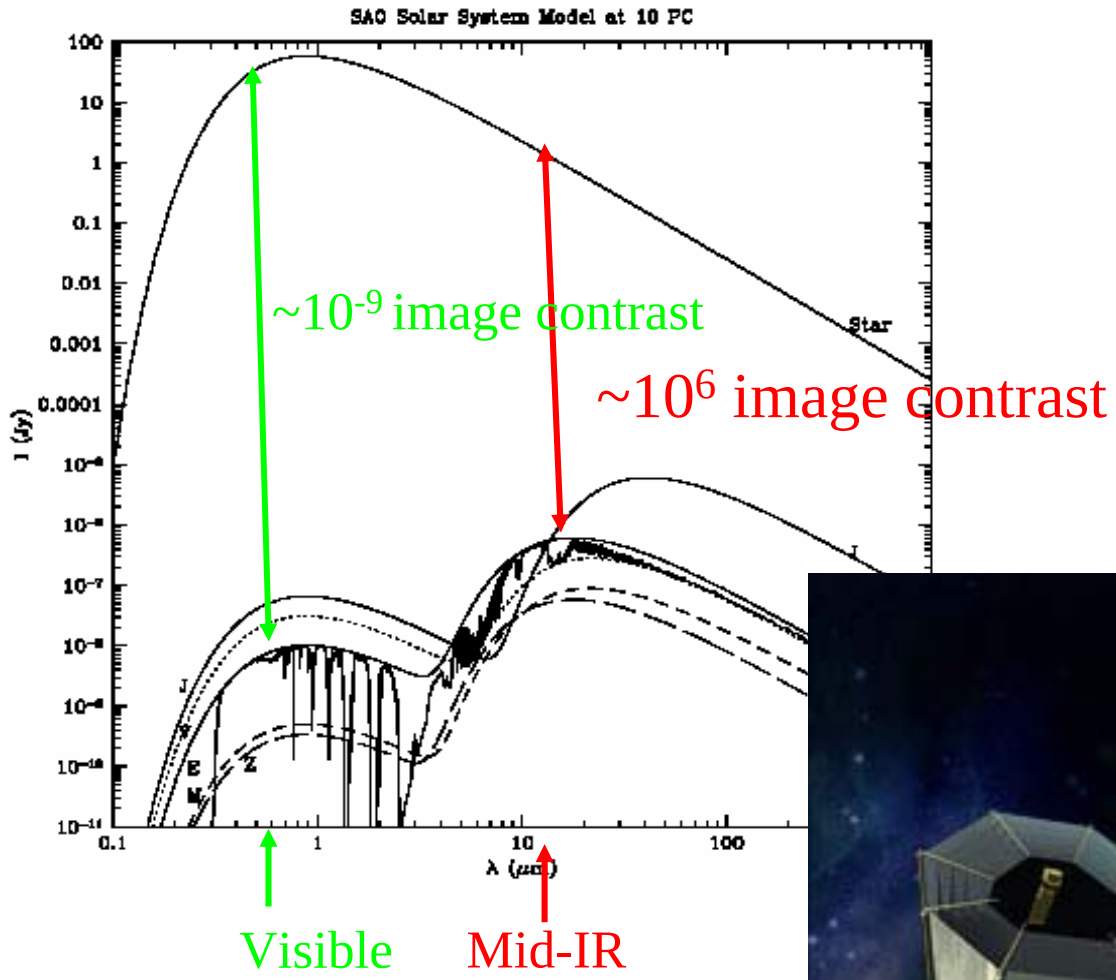
Catanzarite, JPL

Optical imaging

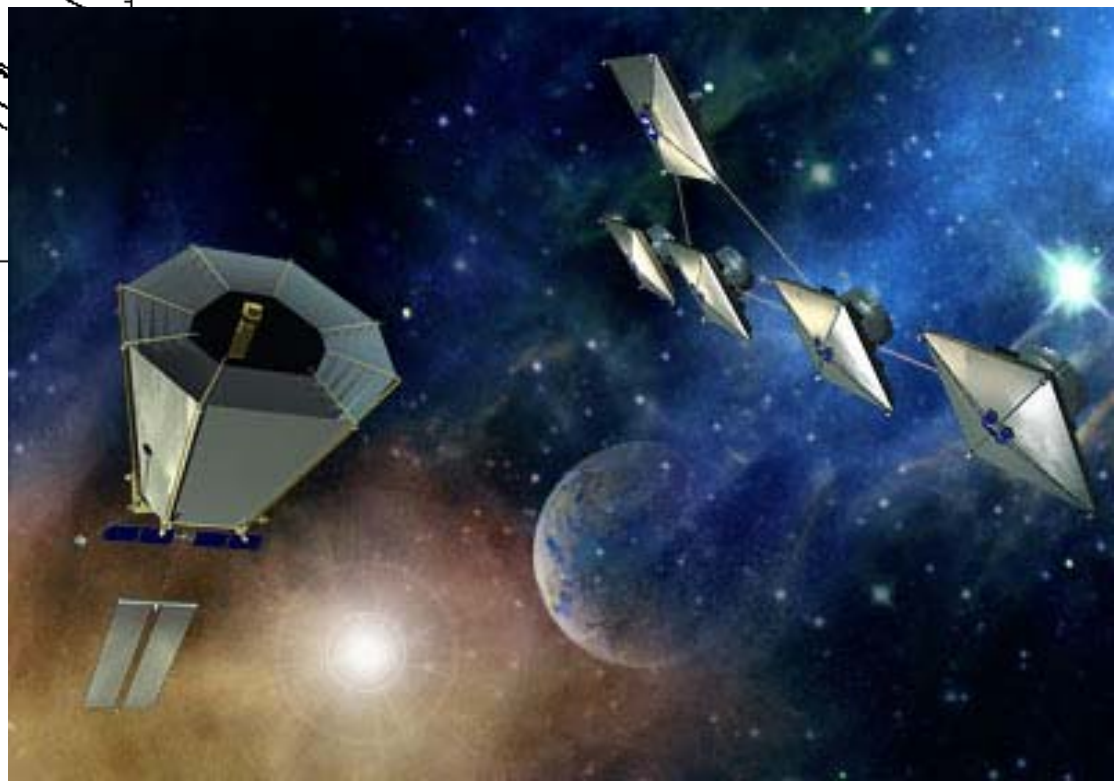
•Terrestrial Planet Finder precursor (~2 m space telescope)

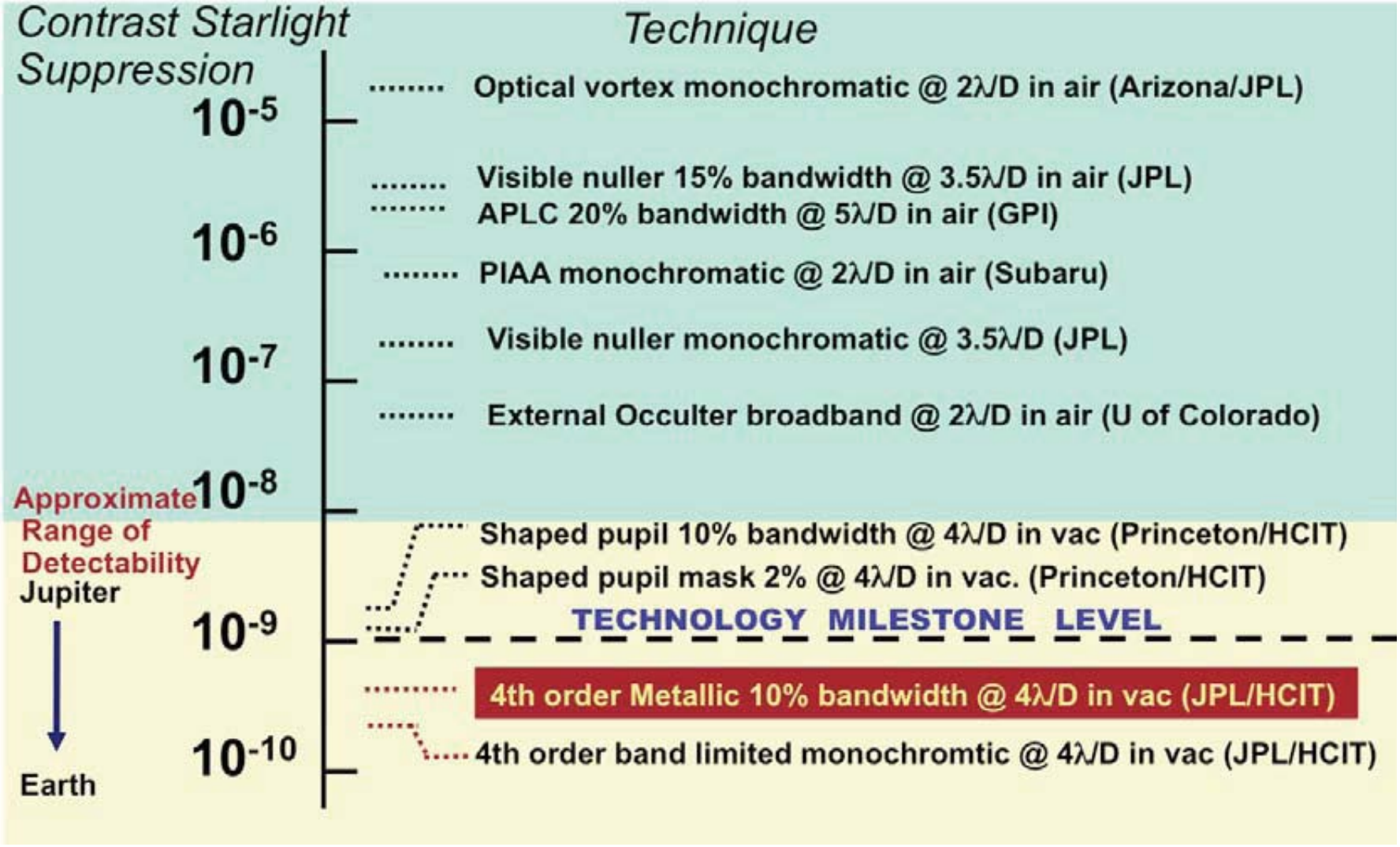
•TPF-coronagraph and TPF mid-IR interferometer, beyond 2020



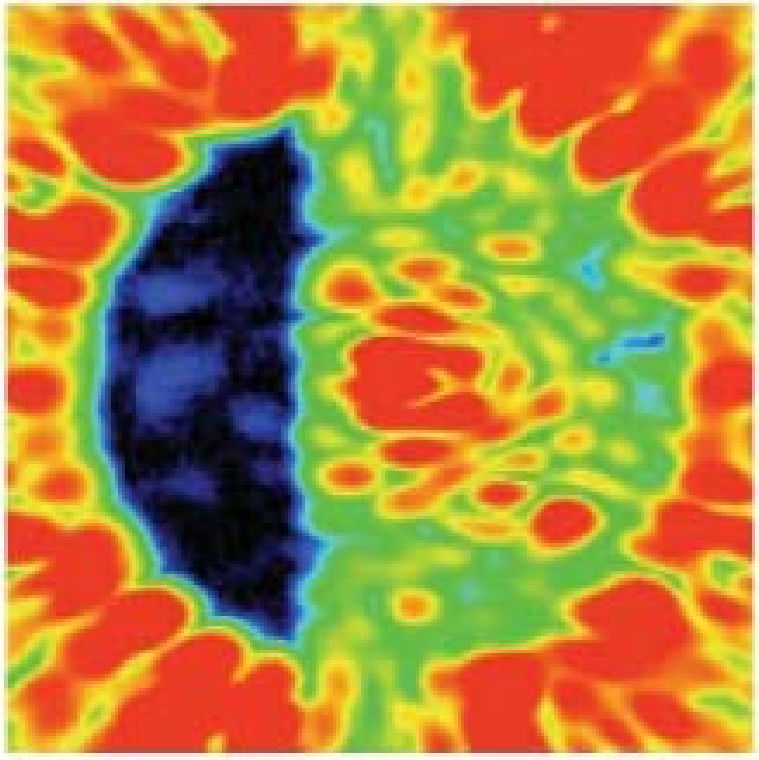

SAO Solar System Model at 10 PC
100
10
1
0.1
0.01
0.001
0.0001
λ (μm)
Star
J
E
Z
~10-9 image contrast
~106 image contrast
Visible
Mid-IR

TPF-C vs. TPF-I





M. Levine, 2008



Contrast averaged across five multi-wavelength EFC iterations over a 5 hour period:

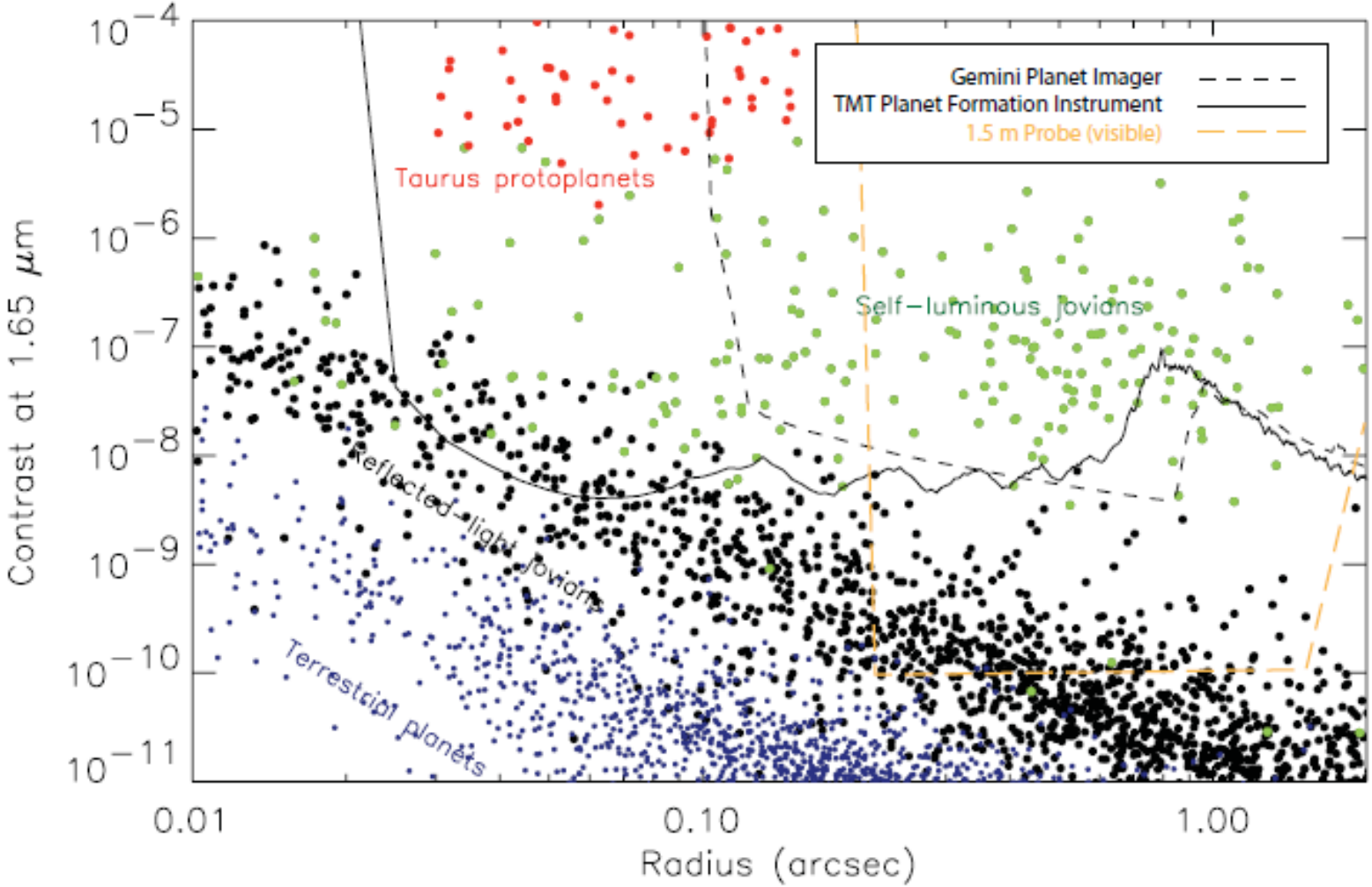
Inner 4-5 lambda/D box:
C = 5.2 e-10

Outer 4-10 lambda/D box:
C = 7.5e-10

Moody et al. 2008

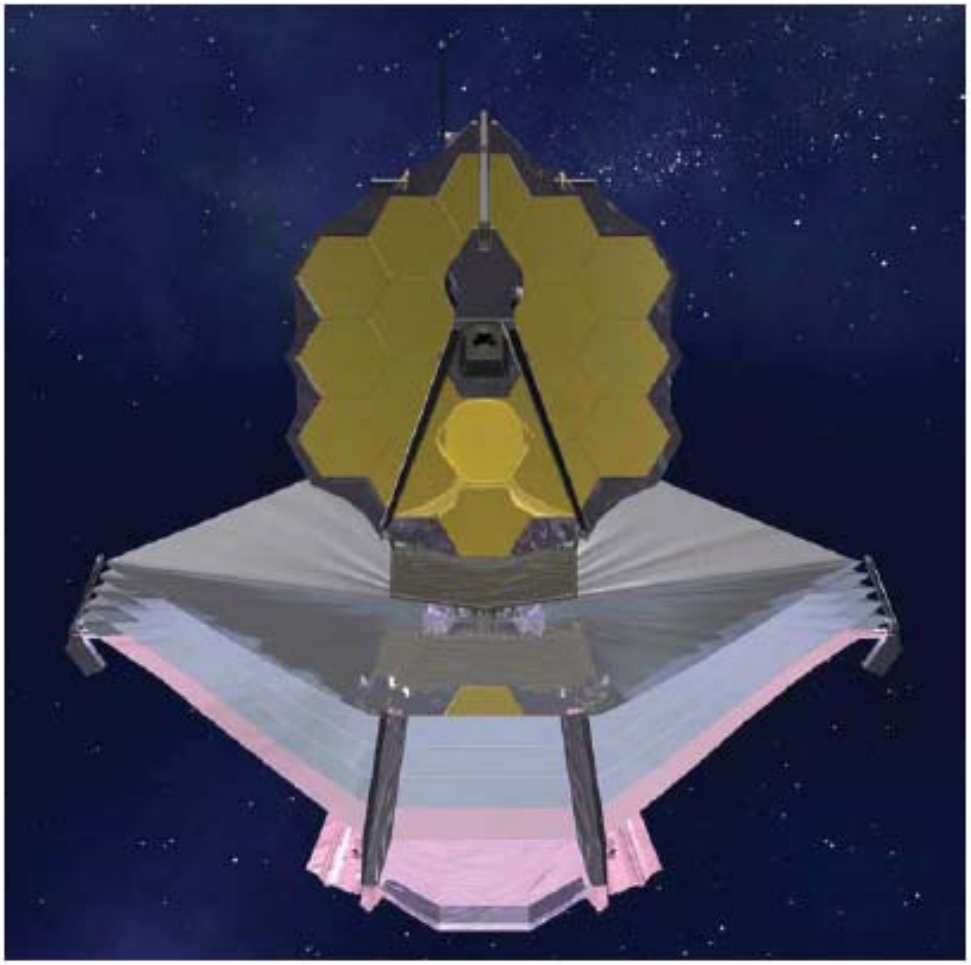
IR imaging

•Ground-based high contrast imaging with 8m class telescopes and future 30 meter class telescopes



Macintosh et al. 2006; R. Soummer; M. Levine

•JWST 6.5 meter telescope, near and mid-IR spectroscopy and coronagraph imaging

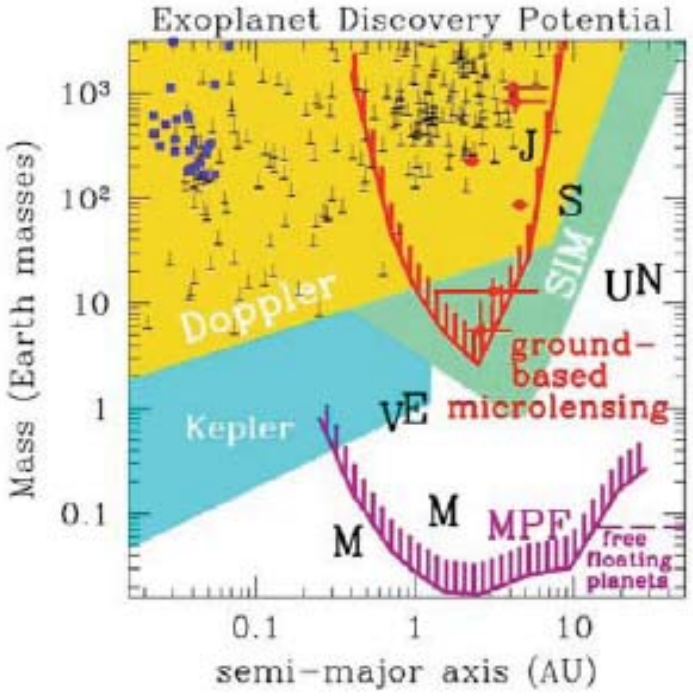


Transit

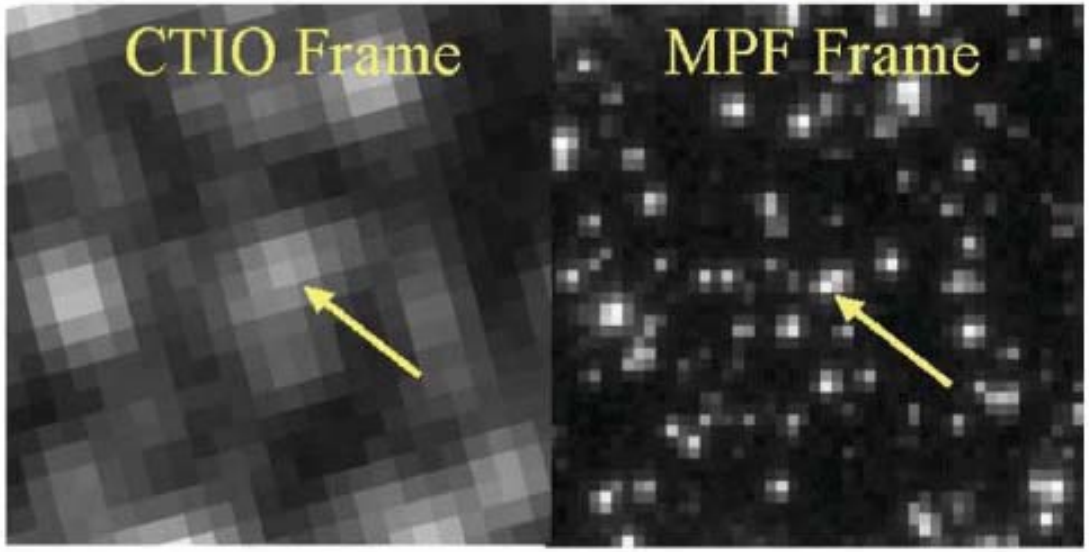
- Transiting Exoplanet Survey Satellite (TESS) (Latham 2008)
  - All-sky survey for transiting planets
    - ~2.5×10^6 selected targets with $4 < I < 13.5$ mag
    - Focus on low mass stars including M dwarfs
    - Has sensitivity to detect Super Earth and possibly Earth-sized planets
    - Expect to detect ~1600 exoplanets
    - All the brightest and nearest transiting planets for follow-up studies by JWST and other future missions

Microlensing from space

•Microlening planet Finder, ~ 0.1 Earth mass around ~1 AU



Bennett et al. 2008



Exoplanet observations for chinese graduate students:

1. Access RV instruments available in China
2. Access RV instruments oversea through collaborations
3. Photometry observations in China
4. Microlensing observations with robotic telescopes (?)

Planet data available to chinese graduate students:

1. Archive data from CoRot and Kepler missions

Access to other planet observation resources through international collaborations:

1. Establish fellowships for studying oversea
2. Organizing more workshops and short schools