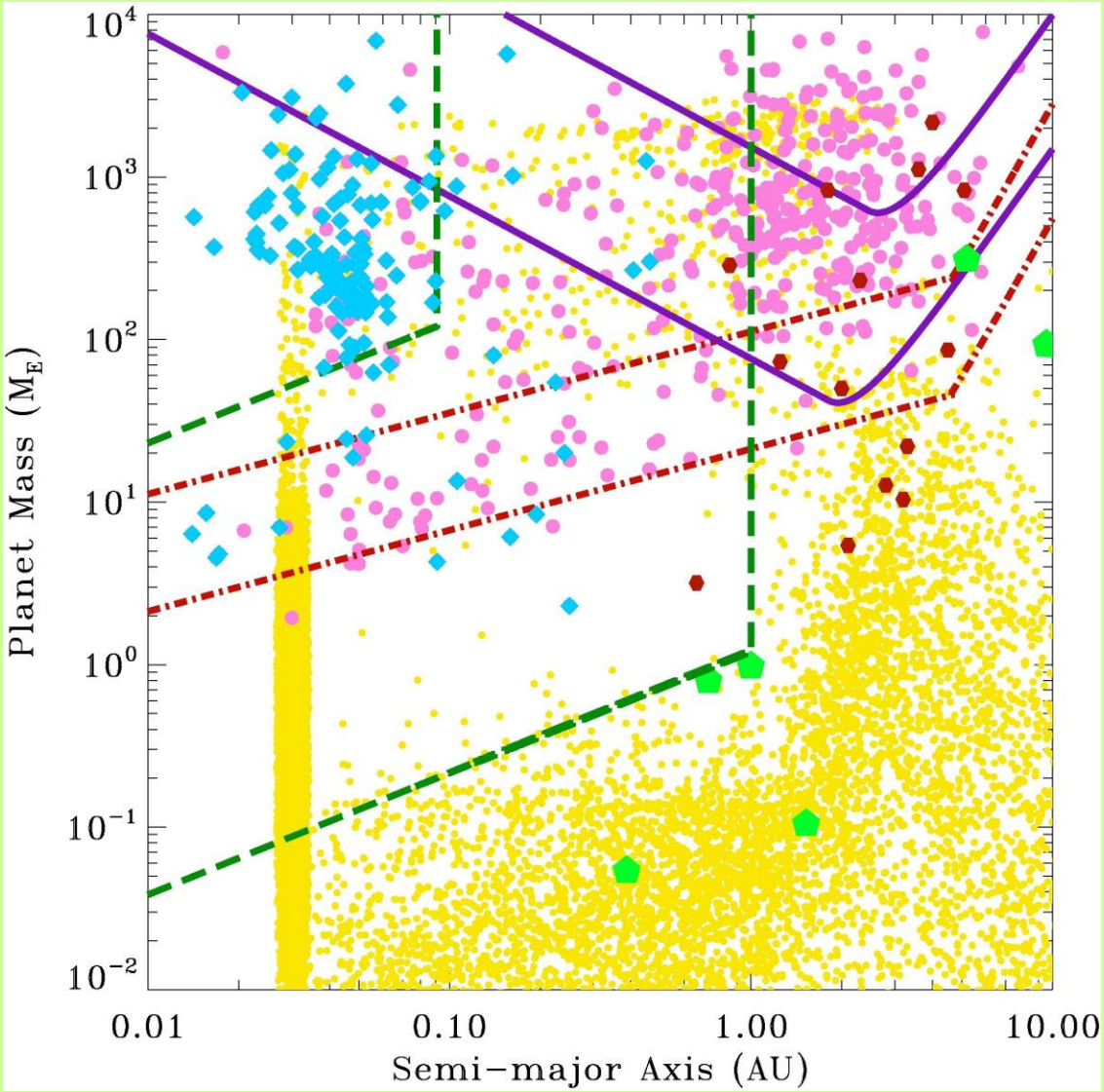
Gaia Discovery Space

1) 2-3 M_J planets at 2<a<4 AU are detectable out to~200 pc around solar analogs
2) Saturn-mass planets with 1<a<4 AU are measurable around nearby (<25 pc) M dwarfs

For Gaia: σ_A ~ 20 μas



Sozzetti 2011

How Many Planets will Gaia find?

Star counts of F-G-K dwarfs (V<13), $F_p(M_p,P)$, Gaia completeness limit

Δd (pc)	$N_\star$	Δa (AU)	ΔM_p (M_J)	N_d	N_m
0-50	~10 000	1.0 - 4.0	1.0 - 13.0	~ 1400	~ 700
50-100	~51 000	1.0 - 4.0	1.5 - 13.0	~ 2500	~ 1750
100-150	~114 000	1.5 - 3.8	2.0 - 13.0	~ 2600	~ 1300
150-200	~295 000	1.4 - 3.4	3.0 - 13.0	~ 2150	~ 1050

Casertano, Lattanzi, Sozzetti et al. 2008

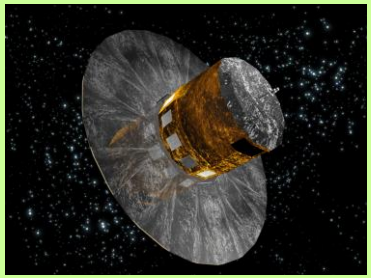
How Many Multiple-Planet Systems will Gaia find?

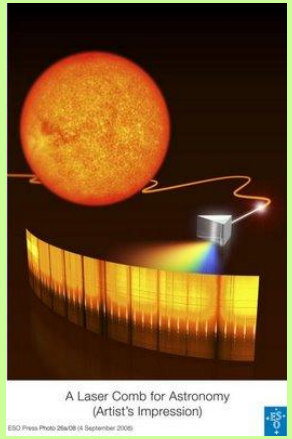
Star counts of F-G-K dwarfs (V<13), $F_{p,mult}$, Gaia detection limit

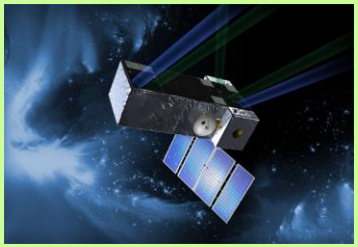
Case	Number of Systems
Detection	~ 1000
Orbits and masses to better than 15-20% accuracy	~ 400 – 500
Successfull coplanarity tests	~ 150

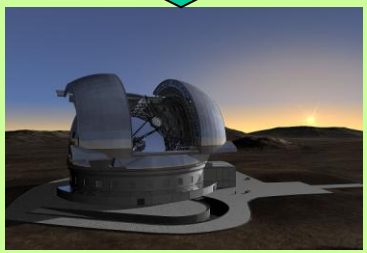
Unbiased, magnitude-limited planet census of hundreds of thousands stars

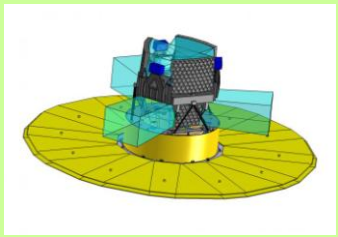
Gaia - Synergies











- Gaia & spectroscopic characterization observatories (e.g., EChO)
- Gaia & transit surveys from the ground (e.g., WASP, APACHE) and in space (CoRoT, Kepler, CHEOPS)
- Gaia & direct imaging observatories (e.g., SPHERE,PCS)
- Gaia & RV programs (e.g., HARPS(-N), ESPRESSO, CARMENES, and the likes)
- Gaia & ground-based and space-borne astrometry

Objectives of study within the GREAT RNP/ITN

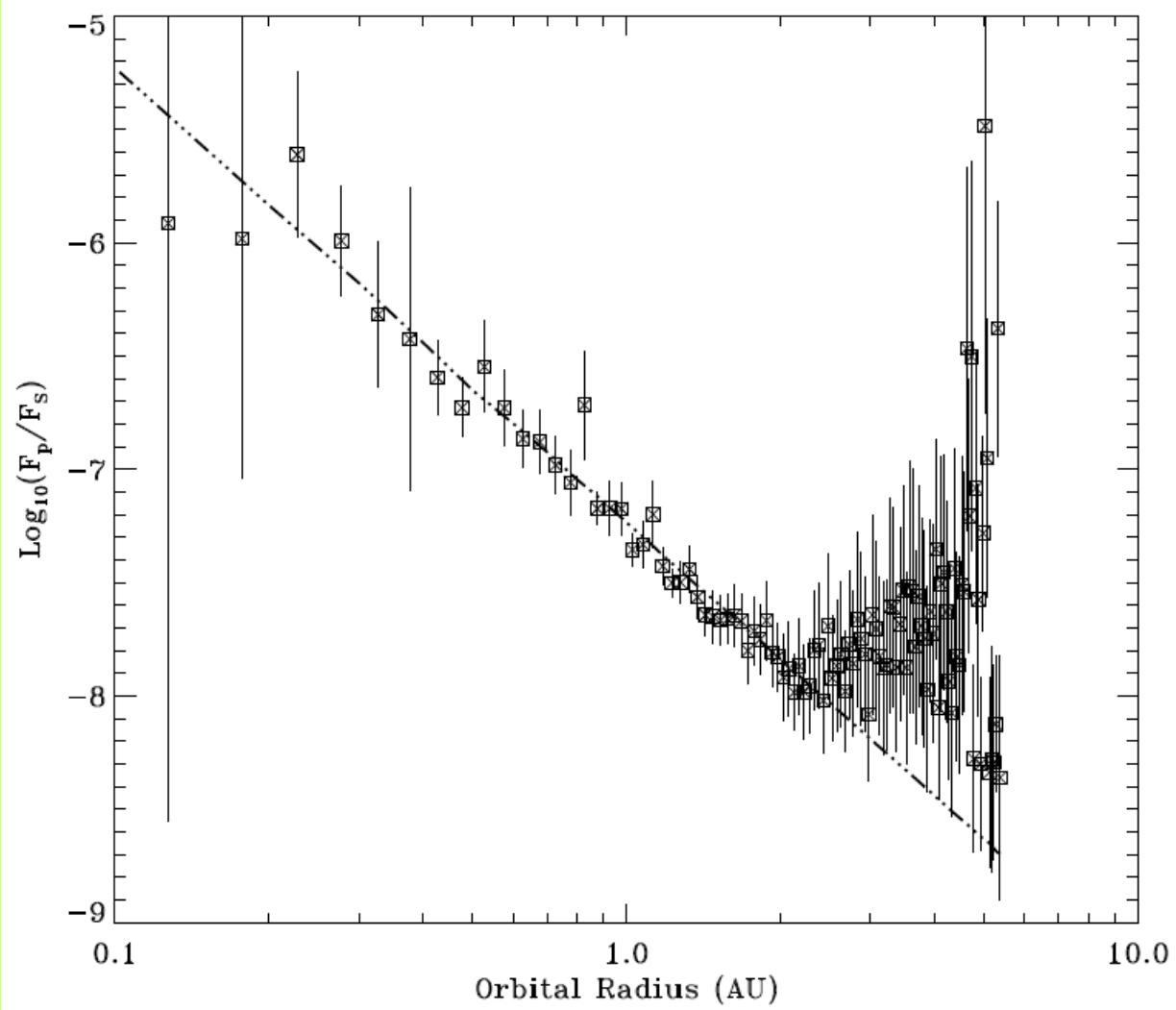
Synergy with RVs

- Complete characterization of systems architectures across orders of magnitude in mass and orbital separation
- Refinement of known orbits
- Complete dynamical stability studies in multiple systems

Atmospheric Characterization

For 0.3<a<3.0 AU, uncertainties in the emergent flux will typically be 10-15%

Potential synergy with direct imaging, reflected light and atmospheric characterization measurements



Hosts of Transiting Planets

- Parallaxes of virtually ALL planet-hosting stars released formally around mid-2016
- For a typical target with V~15 at d~ 20(500) pc, expect $\sigma(\pi)/\pi<0.1(2\text{-}3)\%$
- Re-calibrate absolute luminosities (particularly at the bottom of the main sequence)
- Derive trigonometric gravities to ~0.03(0.05) dex
- Re-determine the stellar radii to <3(5)% accuracy
- Great synergy with ground-based and space-borne transit surveys