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Masses and Radii for CoRoT-Planet Populations from Formation Theory

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Masses and radii are the primary observables to characterise exoplanets today.

A self-consistent theoretical approach is presented that allows to calculate mass- and radii-distributions of exoplanet populations from basic physical principles and avoids the usual parametrisation of a multitude of processes.

The theoretical strategy has two steps:

1) Calculate all planetary equilibria that can satisfy hydrostatic and thermal equilibria in arbitrary but gravitationally stable protoplanetary nebulae and with planetesimal accretion as energy source;

2) Calculate the quasi-hydrostatic evolution of the ensemble of planets found in step one, to the ages that are relevant for observations.

Results are presented for host star masses of 0.4 to 2 times the one of the Sun and orbital periods from 1 to 128 days.

(1) The bi-modality of the mass-distributions is enhanced by the planetary evolution from the formation era into the present. (2) The observed planetary radii can be explained without the assumption of extra, non-standard energy sources. (3) A wide gap is found between the transit signals of Pegasi-planets (Hot Jupiters) and the next population towards smaller radii: the Hot Neptunes.

A comparison with the CoRoT and Kepler results gives a first hint
that the approach is useful to explain the observed planets.