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Composition, Structure and Formation of Low-Density Planets Within 0.5 AU of Their Star

Kepler has discovered that tens of percent of sunlike stars possess one or more planets larger than Earth within 0.5 AU. Masses of dozens of small and mid-sized exoplanets have been measured using radial velocity or transit timing variations. Few transiting planets larger than 1.6 Earth radii are rocky. Rather, the planetary mass-radius diagram for planetary radius between 1.6 and 8 times that of Earth shows a tendency for mass to increase slowly with size. The scatter is larger than can be explained by observational errors and correlations with temperature, implying that the population is heterogeneous. Many Neptune-size planets have very low densities and must have a substantial fraction of their volumes occupied by hydrogen and/or helium. Models of the structure, growth and evolution of planets made of mixtures of rock and light gases will be presented and compared with observations of both individual bodies and of the characteristics of the population as a whole.