

Title: The Formation of Planets from the Direct Accretion of Pebbles

Abstract:

A radical new scenario has recently been suggested for the formation of giant planet cores that reports to solve this long-standing problem. This scenario, known as pebble accretion, envisions: 1) Planetesimals form directly from millimeter- to meter-sized objects (the pebbles) that are concentrated by hydrodynamic forces and then gravitationally collapse to form 100 – 1000 km objects (Cuzzi+ 2008, AJ 687, 1432; Johansen+ 2007, Nature 448, 1022). 2) These planetesimals quickly sweep up the remaining pebbles because their capture cross sections are significantly enhanced by aerodynamic drag (Lambrechts & Johansen 2012, A&A 544, A32; Ormel & Klahr (2010) A&A Volume 520, id.A43). Calculations show that a single 1000 km object embedded in a swarm of pebbles can grow to ~10 Earth-masses in less than 10,000 years. However, recent full-scale simulations of core formation with this process have failed to reproduce the giant planets in the Solar System (Kretke & Levison 2014, AJ 148, 19). I will discuss a new modification to the basic pebble accretion picture that appears to solve this problem and apply these new ideas to the terrestrial planet region.