

Directly Imaged Companions: Planets or Brown Dwarfs?

Mark Marley (mmarley at mail.arc.nasa.gov), NASA Ames Research Center

Outside of the solar system, the epithet 'planet' has been hung on a motley collection of low mass objects. Free floating 'Jupiters', directly imaged faint companions, and of course objects detected by radial velocity and other indirect methods have all been so marked. But are all these objects really planets? Like Justice Potter Stewart, we each know a planet when we see it. The problem, of course, is that not everyone ultimately issues the same opinion. In an attempt to shed some light on the question given in the title, I will briefly review what we know of the formation and evolution of giant planets. I will then argue that a 'true' giant planet forms from accretion processes in a nebula surrounding its primary star. It does not form by fragmentation. Formation processes leave fingerprints on both the composition of the atmosphere of the planet and on its evolution through time, at least during its youth, which can be discerned remotely. Thus my definition for a giant planet would require a bulk or atmospheric composition that differs materially from its primary and a luminosity, radius, or both that at young ages differs from that of an object formed by fragmentation. Both components of this definition are, for now, theoretically motivated but can be tested when a sufficient number of objects are directly detected and trends are apparent. In my talk, I'll apply this definition to the directly imaged companions and will also consider the limitations of this approach.