ATMOSPHERIC MASS LOSS AND TIDAL EVOLUTION OF EXOPLANETS

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Introduction: The book on planet formation has been completely rewritten with the discoveries of hundreds of exoplanet systems. For example, close-in exoplanets, planets within 0.1 AU of their host stars, seem to be common among extra-solar systems but do not exist in our own solar system. These planets probably formed much farther from their host stars, and interactions with their maternal gas disks or with their sibling planets drove them to their current close-in orbits.

The distribution of their semi-major axes and masses can provide clues as to which migration scenario occurred, but only to the extent that subsequent effects can be factored out. In particular, tidal forces and atmospheric mass loss caused by stellar ultraviolet flux can shape these distributions after the planets arrive near their current orbits, and origin scenarios for these planets must consider these two processes. Atmospheric escape, for example, may completely remove the atmosphere of a Neptune-mass planet, or orbital decay from tides may cause a planet of a few Jupiter masses to spiral into its host star, both in a few Gyrs.

When effects of tides and mass loss are coupled, they may help explain gaps in the distribution of mass and semi-major axes for close-in planets shown below. However, these two effects have up to this point generally been considered in isolation. In this presentation, we will describe how these processes together have shaped the observed masses and orbits of close-in planets.

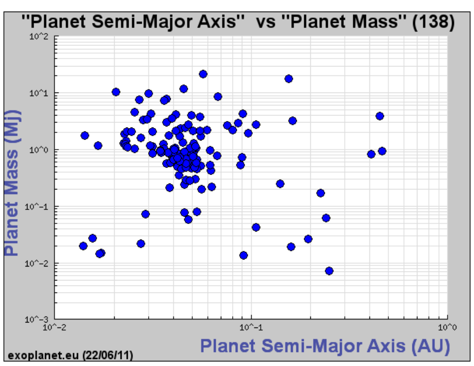

Figure 1: Data for this figure was retrieved from the website exoplanet.eu on July 27, 2011