Geophysical Research Abstracts, Vol. 7, 00304, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00304

Classification and the stability of the isothermal protoplanetary equilibria

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The work aims to clarify some basic concepts of the giant planet formation.
In order to enhance the understanding of the general roadmap of the giant planet formation we mapped out all the qualitatively different protoplanetary equilibria, for a simple isothermal self-gravitating core-envelope model.
A clear concept for the distinction between a planet and a minor body naturally follows from our static classification. We explain e.g. why Titan has an atmosphere, while Ganymede can't have one.
We examine the role of so-called critical mass, necessary to permanently attract gas of the protoplanetary nebula to a terrestrial-planet-like, heavy element core.
To determine the subset of the physically significant protoplanetary solutions, as well as to investigate the role of the stability in the formation of the planets, we perform the non-linear stability analysis - the evolution of the models which are the typical representatives of their class is followed on a timescale of the envelope dynamics.