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国台学术报告 NAOC COLLOQUIUM

2019 年 第 25 次 / No. 25 2019

Time: Wednesday 2:30 PM, Oct. 30th Location: A601, NAOC

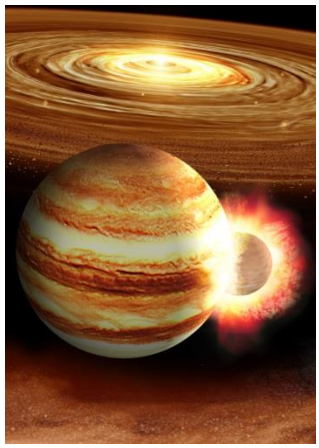
A Tale of Gas Giant Planet Formation: New Insights into Jupiter's Diluted Core

Dr. Shangfei Liu

Sun Yat-sen University

Dr. Shangfei Liu obtained his PhD degree from Peking University in 2013 under the supervision of Prof. Doug Lin. He did his first postdoc at the University of California at Santa Cruz with Prof. Erik Asphaug and Prof. Doug Lin from Sep. 2013 to Nov. 2015. Then he spent one year in Los Alamos National Laboratory as a visiting scholar in Dr. Hui Li's group. After that, he moved to Rice University as a postdoc to work with Prof. Andrea Isella. In December 2018, he joined the faculty of School of Physics and Astronomy at Sun Yat-sen University in Zhuhai China.

Abstract



The Juno mission has provided an accurate determination of Jupiter's gravitational field, which has been used to obtain information about the planet's composition and internal structure. Several models of Jupiter's structure that fit the probe's data suggest that the planet has a diluted core, with a total heavy-element mass ranging from ten to a few tens of Earth masses, and that heavy elements are distributed within a region extending to nearly half of Jupiter's radius. Planet-formation models indicate that most heavy elements are accreted during the early stages of a planet's formation to create a relatively compact core and that almost no solids are accreted during subsequent runaway gas accretion. Jupiter's diluted core, combined with its possible high heavy-element enrichment, thus challenges standard planet-formation theory. In this talk, I will discuss a revision to the conventional picture of gas giant formation, i.e. a planetary bombardment phase shortly after the runaway gas accretion of a gas giant. We show that a sufficiently energetic head-on collision between a large planetary embryo and the proto-Jupiter could have shattered its primordial compact core and mixed the heavy elements with the inner envelope. Models of such a scenario lead to an internal structure that is consistent with a diluted core, persisting over billions of years. We suggest that collisions were common in the young Solar system and that a similar event may have also occurred for Saturn, contributing to the structural differences between Jupiter and Saturn.

All are welcome ; Tea and coffee will be served at 2:15 PM.