A comprehensive theoretical-experimental framework for studying the formation and evolution of dwarf planets and small bodies

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Laufzeit:

Our entire Solar System formed 4.6 billion years ago from a disk of gas and microscopically small dust particles. Models and astronomical observations of other planetary systems at all stages of their evolution show that within several million years the Sun, the terrestrial planets Mercury, Venus, Earth and Mars, the giant gas planets Jupiter and Saturn and the ice planets Uranus and Neptune formed. However, all these bodies are so large that any traces about their formation processes were long lost, because of their high internal temperatures and pressures. Fortunately, there are many smaller bodies in the Solar System present, such as comets, asteroids, Kuiper-Belt objects and dwarf planets, which might, due to their much small sizes and correspondingly low internal pressures and temperatures, be better witnesses to the formation era than the eight planets. Using state-of-the-art computer models and laboratory experiments the scientists will systematically study the formation and evolution of small bodies in the Solar System and to which extent these objects still bear witness to their formation processes. The laboratory experiments, preferentially performed at TU Braunschweig (Lower Saxony), will reveal the collision behavior, the mechanical strengths, the thermal properties and the outgassing behavior of small bodies. The computer models, a specialty of Technion (Israel), will comprise simulations of collisions among small planetary bodies to determine whether these objects grow or are disrupted, the evolution of the orbits of these bodies and their interaction with the gravity field and irradiation of the Sun. The unique combination of laboratory work, which can deliver important empirical information on the state of primitive planetary matter, and computer simulations, using these data, will lead to predictions of the appearance of modern planetary systems from assumed initial conditions. By comparing with the present Solar System or exoplanetary systems, the researchers will be able to constrain formation and evolution processes and to determine, which group of planetary objects would be best suited for an origin-dedicated exploratory mission.

Projektbeteiligte

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Es werden die Institutionen genannt, an denen das Vorhaben durchgeführt wurde, und nicht die aktuelle Adresse.