SPS1

The Galileo Mission to the Jupiter System

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This Special Session of the International Astronomical Union and the papers included here are dedicated to the memory of Dr. Jurgen Rahe, Scientist, Director of the NASA Solar System Exploration Program, and enthusiastic advocate for planetary science.

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THE JUPITER SYSTEM

Introductory Remarks

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The last two decades brought a rich harvest of information about the outer planets, their satellites, and their ring systems that dramatically improved our knowledge about these bodies and evolutionary processes in the Solar System. This progress was due both to the successful Pioneer and Voyager missions, and to progressively improved techniques of ground-based observations. These data give insight into numerous new phenomena and mechanisms operating on the outer planets and also give important clues about the intimate relationships between all objects of the Solar System family. Results from the Galileo probe and orbiter have taken us further along that track.

Jupiter, its environment, and satellite system represent a unique formation that is controlled by the enormous gravity and magnetic fields of the planet, its relatively distant position from the Sun, and continuing heat release from the interior. Jupiter represents other members of the giant planets family as well — large, mostly gaseous bodies which are assumed to have been preserved essentially unchanged since their origin. Of specific interest is the immensely deep, reducing atmosphere of Jupiter, dominated by hydrogen and helium and other elements forming compounds with hydrogen. However, the abundances of minor species, as well as the atmospheric structure and the dynamics involving many peculiar features of the global circulation and its interaction with the strongly developed convective processes, remain unclear.

Galileo data clearly show that some previous ideas and models of the Jupiter atmosphere based on limited knowledge were oversimplified. Many important questions are also related to the composition and height distribution of Jupiter's clouds, which give evidence of the presence of multiple and subtle shades of colors for which rather complex compounds could be responsible. It is not yet clear to what extent energetic charged particles precipitated from the magnetosphere and lightning discharges affect the atmospheric chemistry and the formation of these enigmatic compounds.

Of special concern is the fact that the chemical reactions occurring in Jupiter's atmosphere today, involving chromophores in the clouds, possibly resemble the chemistry that occurred in the earliest history of our Solar System. In this regard many important questions about the origin of the atmospheres of Jupiter and other giant planets are related to problems of evolution of gases and ices in the region of Jupiter's orbit and beyond. The composition, internal structure, and evolutionary paths of the Galilean satellites and contemporary processes on their surfaces also give insight into the earliest conditions around Jupiter. Of special interest are specific morphological features closely related to the geological evolution and interior structure. In particular, many intriguing questions are directed to the specific patterns on the surface of Europa, and their relationship with liquid water possibly containing some primordial organics.

These and other relevant problems were included in the quite comprehensive program of the Galileo scientific session. This session was a good forum for the further advancement of knowledge in the challenging area of Solar System exploration.

J. Andersen (ed.), Highlights of Astronomy, Volume 11B, 1041.