



doi:10.1038/nindia.2008.177; Published online 9 April 2008

Research highlight

Lifting the veil from Jupiter's cloud

Biplab Das

Sending a space probe to a remote outpost like Jupiter is fraught with dangers because of the unpredictable nature of the planet's atmosphere. An international team comprising Indian and US researchers has provided vital insights into the ionization process of Jupiter's cloud, the portion mainly bombarded with galactic cosmic rays (GCR)¹ (#B1). This would help future probe missions to measure the atmosphere and electrical properties of the cloud.

Sun's ultraviolet rays cause ionization of Jupiter's cloud. High-energy GCR particles also trigger this ionization. Relying on data from the Voyager spacecraft and Galileo space probe, the researchers generated a computer-based model and uncovered the GCR triggered ionization process of the cloud at varying pressures and altitudes.

They computed the electrical conductivity and electrical charge on cloud particles (composed of ammonia, ammonium hydrosulfide, and water) in the atmosphere of Jupiter at pressures between 5.5 and 0.1 bars. GCRs are the prime ionization agents in the dense atmosphere. They produce a cascade of particles, which in turn produce electrons and positive ions. These electrons and positive ions then attach to cloud particles.

The team found that large reduction in atmospheric conductivity can lead to significant charging of cloud particles, which can create charge separation, and lightning. "Lightning is one of the prerequisite for the formation of large precursor molecules of life," says co-researcher Sachchida Nand Tripathi from the Department of Civil Engineering of Indian Institute of Technology, Kanpur, India.

"It will also make future missions safer as large charging or discharging (high electrical field) can damage the spacecraft," he says.

The authors of this work are from: *SETI Institute, Mountain View, California, USA; NASA Ames Research Center, Moffett Field, California, USA; Department of Physics and Astronomy, Northern Arizona University, Flagstaff, Arizona, USA and Indian Institute of Technology, Kanpur, India.*



Understanding Jupiter's cloud will help future missions.

NASA

References

1. Whitten, R. C. *et al.* Predictions of the electrical conductivity and charging of the cloud particles in Jupiter's atmosphere. *J. Geophys. Res.* **113**, E04001 (2008) | [Article \(http://dx.doi.org/10.1029/2007JE002975\)](http://dx.doi.org/10.1029/2007JE002975) |