



# Physical Research Laboratory, Ahmedabad

## Special Colloquium 19-01

- Speaker:** Prof. Sushil Atreya  
Director, Planetary Science Laboratory, University of Michigan, Ann Arbor, USA
- Title:** "Formation of the Icy Giant Planets: In Situ Exploration"
- Time:** Friday, 18 January 2019, 16.00 hrs.
- Venue:** K.R. Ramanathan Auditorium, PRL

### Abstract

Icy giant planets, Uranus and Neptune, are the missing pieces of the puzzle of the formation and evolution of the outer solar system. A comprehensive set of observations from spacecraft comprising an orbiter and probe are essential to address the most important questions about the composition and structure of the atmosphere, ionosphere, magnetosphere, rings and the satellites. This talk will focus on the measurements that are essential to constrain the formation and evolution scenarios. Entry probes alone are capable of making those measurements.

### The Speaker

Sushil Atreya is a professor of Atmospheric and Space Sciences at the University of Michigan and director of its Planetary Science Laboratory. His field of research is the origin and evolution of planetary and satellite atmospheres. His expertise is exceptionally broad, ranging from photochemistry to radiative transfer modelling, planetary mass spectroscopy, to the development of instrument concepts. He has played a key role in most of the planetary missions of the past decades. He has published over 200 refereed papers with over 8500 citations and has given more than 200 invited talks. A focus of his research has been the photochemistry of Titan. He has predicted  $\text{H}_2\text{CN}^+$  (carbon-protonated hydrogen cyanide) as its major ion – a prediction later confirmed by Cassini – and ammonia as the source of the thick nitrogen atmosphere, which was later confirmed by Voyager. He has modelled the methane cycle of Titan and has shown its similarity with the water cycle on Earth. For the giant planets, Atreya derived thermochemical models of their cloud structures and provided evidence for enrichment in heavy elements of Jupiter's atmosphere, which he interpreted in terms of the icy planetesimal formation model of Jupiter. For Mars, Atreya studied the photochemical stability of the Martian atmosphere, including the possible role of catalytic heterogeneous processes, modelled the electrochemistry in Martian dust devils and storms and possible implications for the formation of hydrogen peroxide and the destruction of organics at the surface of Mars. He further studied the possible sources and sinks for methane and helped with the in-situ detection of methane by the Curiosity rover team. In addition, he provided the first high-precision measurement of primordial argon isotope ratios on Mars and discussed their implication for the early history of the planet. Atreya always considered the implications of his empirical findings for the origin and evolution of the planet or the satellite he was studying. He proposed new models of the formation of Jupiter, the evolution of Titan and the early history of Mars. His two books – 'Atmospheres and Ionospheres of Outer Planets and their Satellites' and 'Origin and Evolution of Planetary and Satellites Atmospheres' (with J. B. Pollack) – have been used as reference works by generations of planetologists. In addition to his research work, Atreya has contributed in major ways to international collaboration. He has been a frequent visiting scientist in Paris and in London. He lectured in L'Aquila (Italy), Lisbon (Portugal) and Grenoble (France). For over twelve years, he has served as co-chair of sessions of the Planetary and Solar System Sciences Programme Group at the EGU General Assembly, and as a guest editor of their proceedings. Dr. Sushil Atreya is the recipient of the 2016 David Bates Medal.

**Tea at 15:30 hrs**  
**ALL ARE WELCOME**

