

The Cycle and Meaning of Methane in the Solar System and Exoplanets (or, everything you (n)ever wanted to know about methane...) (David Bates Medal Lecture)

Sushil Atreya

University of Michigan, Climate and Space Sciences, Ann Arbor, United States (atreya@umich.edu)

Methane is a signature of life as we know it. Only a small fraction of Earth's methane is abiogenic. In the giant planets, methane provides a key constraint to their formation scenarios. Thus, a significant effort is being made to understand the origin, role and the fate of methane on terrestrial planets, giant planets, planetary moons with atmospheric volatiles, and exoplanets. While the proportion of methane in the giant planets is relatively large, it spans a wide range, from non-existent (Venus) to trace (Earth, Mars, Enceladus, Triton, Pluto) to substantial (Titan), in the rest of the solar system. This diversity reflects the manner in which methane was acquired or made, retained, transformed, and evolved. Biology, geology, chemistry and primordial processes are central players in these processes in the solar system. The solar system serves as the best analog so far for the extrasolar planets, in whose environments also characterization of methane is likely to lead to valuable insights into their nature. In this talk I will attempt to synthesize our current understanding and significance of methane in the solar system and beyond.