Astrochemistry and Planet Formation

In the past few years, a number of rocky, temperate exoplanets have been identified. How often can we expect such planets to be hospitable to life from a chemical point of view? In other words how often do such planets acquire water, and a rich organic inventory? In this talk I will argue that characterizing the chemistry of disks around young stars, the formation sites of planets, is key to address the likelihood of finding life on planets, and to identify life when present. The most direct path to constrain the chemistry in disks is to directly observe it. The arrival of the Atacama Large Millimeter and submillimter Array (ALMA) has provided us with the perfect tool to do exactly that. Recent ALMA highlights include observations of condensation fronts or snowlines, maps of small organic molecules, and first detections of more complex ones. Observations can only provide chemical snapshots, however, and even ALMA is blind to the complete chemical composition of disks. Therefore we are, in parallel, using astrochemistry models and laboratory experiments to deduce the origins of the observed molecules, and to explore the possibility of a more complex organic astrochemistry than is currently possible to observe. In this colloquium I will briefly introduce the field of astrochemistry, and then present some of our latest observational and laboratory discoveries on the chemistry of planet-forming disks. I will discuss the impact of these discoveries on the likelihood of finding chemically habitable exoplanets, and also how our growing understanding of the chemistry of planet formation is providing an interpretive key for Solar System observations.

Karin I. Öberg

Professor of Astronomy

Harvard University

Harvard-Smithsonian Center for Astrophysics

60 Garden St, MS 16

Cambridge, MA 02138 USA