Karen Meech Abstracts

Forming a Habitable Planet – How Earth Got Its Water

Life on Earth depends on an aqueous biochemistry, and water is a key component of habitability on Earth, for likely other habitable environments in the solar system, and for extrasolar planetary systems. While water is ubiquitous in the interstellar medium, and plays a key role in protoplanetary disk chemistry, the inner solar system is relatively dry. We now have evidence for potentially thousands of extrasolar planets, dozens of which may be located in their host star's habitable zones. Understanding how planets in the habitable zone accrete their water, is key to understanding the likelihood for habitability. Given that many protoplanetary disk models show that Earth formed inside the water-ice snow line of our solar system, and thus it would have been harder to accrete much water to Earth, understanding how the inner solar system received its water is important for understanding the potential for other planetary systems to host habitable worlds. Boundaries for the timing of the water delivery are constrained by cosmochemistry and geochemistry. Possible scenarios for the delivery of water to the inner solar system include adsorption on dust from protoplanetary disk gas, chemical reactions on the early earth, and delivery from planetesimals forming outside the water-ice snow line. Understanding the origin of Earth's water will require astronomical and geochemical observations of multiple isotopic fingerprints in a variety of solar system volatile reservoirs. These must be compared with a suite of disk chemical models and dynamical models for planet accretion. This talk will present information about our current understanding of how volatiles were distributed in the early solar system, and which measurements can be done from Earth, and which require in-situ space exploration. If, in the end, it turns out that our solar system required some special process to get water to a planet in our Sun's "habitable zone", then this could have profound implications for the presence (or lack thereof) of life elsewhere.