**Organic molecules in the outer solar system and beyond**

Pr. Christophe Sotin (Laboratory of Planetology and Geodynamics, Nantes)

Organic molecules are ubiquitous in outer solar objects. The Rosetta mission revealed that organics are a major compound of cometary refractory material. The samples returned from asteroid Ryugu by the Hayabusa 2 mission are also rich in organics. This organic material may have played a critical role in the evolution of larger objects such as the icy moons of Jupiter and Saturn because organics have transport properties quite different from those of silicates. In addition, the presence of carbon-rich material may explain the surprising low density of their cores. Among those moons, at least four have a global ocean beneath a thick icy crust. They belong to the family of Ocean Worlds. The presence of both water and organic material raises the question of the habitability of these worlds. With the help of laboratory experiments and state of the art numerical simulations, we are exploring the role of organics in the thermochemical evolution of these icy moons. We expand the work to exo Ocean Worlds. The observations to be made by the instruments on the recently launched ESA JuIcE mission will confirm (or not) the role of the organics in shaping the interior composition and dynamics of Ganymede. The NASA missions Europa Clipper and Dragonfly will constrain these models for Europa and Titan, respectively. Finally, the James Webb space telescope (JWST) and two ESA space telescopes, Plato and Ariel, may shed light on the composition of exo-Ocean Worlds.