

Bioastronomical Aspects of Titan and the Giant Planets

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Organic chemistry in extraterrestrial environments is an important aspect of Bioastronomy. All the outer planets, from Jupiter to Neptune (and even Pluto) involve organic chemical processes, through the chemistry of their atmosphere, and methane photochemistry. They also occur in the dense atmosphere of Titan, the largest satellite of Saturn, (in the gas and aerosol phases), in the much thinner atmosphere of Triton, the largest satellite of Neptune (mainly in the solid phase, on its surface), and on the surface of many of the other satellites of the outer planets.

Although the chemistry of these environments has been studied in some detail, many questions still remain, such as:

- What are the processes involved in the formation of HCN in the atmosphere of Neptune ?
- What is the chemical nature of the aerosols of Titan ? How representative of these particles are the so-called “tholins” (refractory organics produced in laboratory simulation experiments) ?
- How realistic are the photochemical models of these environments, such as Titan’s atmosphere, and what are the uncertainties in such models ?
- How complex is Titan’s organic chemistry ?

These questions will be discussed on the basis of the latest results from the three complementary approaches which can be followed:

- experimental simulations using model atmospheres and dedicated chemical reactors,
- theoretical modeling based on the development of O-D to 3-D photochemical models,
- observational approaches by remote sensing or in situ analysis techniques.