

## Foreword

The interstellar matter, blown by enriched stellar winds and dispersed by supernovae, travels from dense regions localized close to the stars toward more diffuse, larger scale phases of the interstellar medium, before being concentrated afresh into molecular clouds prior to new star formation. During this life-cycle, grains of cosmic dust at the submicron scale condense in the ejecta of evolved stars, before growing by coagulation and later are incorporated successively into the solid bodies of planetary systems. These grains are continuously processed during this journey and are also strongly coupled to the surrounding gas. This gas is in fact composed of a surprisingly complex distribution of molecules in addition to the primordial gas, in regard to the extreme conditions that prevail in the diverse interstellar environments. The presence of highly reactive gaseous molecules underlines an extremely active gas phase chemistry, but the role of heterogeneous chemistry is also recognized as being of peculiar importance.

Exploring this diverse chemistry and modeling its behavior in the astrophysical media are major challenges for modern astrophysics. All the encountered scientific aspects make astrochemistry a strongly interdisciplinary research field. Gas phase chemistry, heterogeneous chemistry and chemistry of solids are all at work in astrophysical media. Thus progress relies almost exclusively on strong collaborations between chemists, chemical-physicists, physicists and astrophysicists. Contributions from sciences developed for a thorough understanding of other reactive media like flames and planetary atmospheres, as well as the physico-chemical evolution of small bodies of the solar system which contain primitive matter are also of major importance. In order to provide the opportunity for all these communities to communicate the main state-of-the-art concepts and tools, a national workshop devoted to the chemistry in astrophysical media has been organized.

This workshop, named AstrOHP, was held in September 2010 in the Observatoire de Haute-Provence (France) and was entirely supported by the Institut de Chimie of the CNRS. About 65 research scientists participated in this 3-day meeting. The scientific program was conceived to follow, so to speak, the journey of extra-terrestrial matter, from the Interstellar Medium down to the Solar System with an introduction to combustion and atmospheric sciences. The contributing papers presented at the workshop compose this proceeding and, because of the national context, French language is sometimes used although most are written in English. Most of the scientific exchanges following the contribution are reported, in French, as well as the final round table devoted to the prospective for the field. The nature of the workshop automatically led to the contributions taking the form of review papers, lecture papers or even prospective ones, the choice being freely left to the author. The present book thus offers a state-of-the-art snapshot of the main concepts and research of all topics that may be of interest to astrochemistry, ranging from the exploration of the different phases of interstellar medium combustion to the problem of the origin of life through the passage into the solar system.