

From interstellar material to cometary particles and molecules

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Comets were formed from remnant inner protoplanetary disk material that was not incorporated into planets and may provide a record of some pristine material from the parent interstellar cloud. Our knowledge on the composition of comets is predominantly based on evaporation of volatile species and thermal emission from siliceous and carbonaceous dust when bright comets approach the sun. The investigation of outgassing curves from bright comets has provided a general link with abundances of ices and gas phase molecules detected in dense interstellar clouds. Theoretical models indicate that bulk material in cometary nuclei is stratified in density, porosity and composition and contains coexisting ice phases, possibly clathrates and trapped gases. It is therefore apparent that the outgassing of species from cometary nuclei will not essentially mimic that expected from pure sublimation of ices of interstellar composition. The high abundance of interstellar macromolecular carbon and the high fraction of insoluble carbon in carbonaceous meteorites indicate the presence of macromolecular carbon in comets. In order to establish a coherent link between interstellar and solar system material an interdisciplinary approach is needed. In this paper we attempt to compile the current knowledge on the connection between interstellar and cometary material, based on observations of interstellar dust and gas, observations of cometary volatiles, simulation experiments, and the analysis of extraterrestrial matter.