LARGE MOLECULES IN COMETS

DOMINIQUE BOCKELEE-MORVAN, *Observatoire de Paris, LESIA, Meudon, F-92195, France*.

A fundamental goal of cometary science is to determine the composition of cometary nuclei. Indeed, it provide clues to the origin of cometary material, to the physical/chemical conditions and processes which occurred in the early Solar Nebula and led to the formation of planets, and to the role of cometary impacts in delivering prebiotic molecules to the early Earth. In the absence of a direct analysis of cometary material, the most efficient way to study comet composition is through spectroscopic observations of the comet atmosphere in the radio and infrared domains. I will review the decisive progress obtained in the last decade concerning the composition of cometary volatiles. In the microwave domain, about twenty molecules were detected, the majority of them in comets C/1996 B2 (Hyakutake) and C/1995 O1 (Hale-Hopp) using the IRAM 30-m and Plateau de Bure telescopes, and the Caltech Submillimeter Observatory. Among the most complex ones, are formic acid, formamide, methyl formate and ethylene glycol[ab]. In addition, upper limits were obtained for several species, including complex organic molecules such as ethanol, acetic acid, glycolaldehyde, glycine...[c]. In the infrared domain, identified species include hydrocarbons CH_4, C_2H_2, and C_2H_6. There are still many unidentified lines in infrared and microwave cometary spectra, showing that available molecular data are still insufficient to analyse these spectra. Several species (e.g., CO, HNC and H_2CO) exhibit spatial distributions and/or heliocentric behaviors suggesting that they are produced in the coma by the degradation of complex organic material. The presence of complex, still unidentified, species was indicated in the exploration of comet Halley from mass spectroscopy. While detailed studies of composition diversity between comets are going on with the current instrumentation, the detection of new cometary molecules will probably have to await for more sensitive instruments, such as ALMA and large infrared telescopes, or new spectral windows, as the submillimeter domain covered by the Herschel Space Observatory.

[a] D. Bockelée-Morvan, D.C. Lis, J. Wink, et al.,*Astron. Astrophys.*, **353**, 1101–1114,2000
[b] J. Crovisier, D. Bockelée-Morvan, N. Biver, etal., *Astron. Astrophys.*, **418**, L35–L38,2004
[c] J. Crovisier, D. Bockelée-Morvan, P. Colom, e t al., *Astron. Astrophys.*, **418**, 1141–1157, 2004