RAMAN PROPERTIES OF VARIOUS CARBONACEOUS MATERIALS AND THEIR ASTROPHYSICAL IMPLICATIONS

A. Blanco,[*] A. Borghesi,[*] E. Bussoletti,[**]
L. Colangeli,[***] S. Fonti,[*] M. Lugara',[****]
V. Orofino[*] and G. Scamarcio[****].

[*]Physics Department, University of Lecce, Italy
[**]Istituto Universitario Navale and Osservatorio Astronomico di Capodimonte, Napoli, Italy
[***]ESA, Space Science Department, ESTEC, Noordwijk, The Nederlands
[****]Physics Department, University of Bari, Italy.

It is well known that a large number of celestial objects exhibit, in the range 3-12 μm, a family of emission features called unidentified infrared bands (UIR). They usually appear together and are associated with UV sources (Russel et al., 1977, de Muizon et al., 1986). Recently various authors (Duley and Williams, 1981, Sellgren, 1984, Leger and Puget, 1984, Allamandola et al., 1985) have suggested that these features could be attributed to solid carbonaceous materials. Following this interest, we have performed a systematic analysis of various types of amorphous carbon grains and polycyclic aromatic hydrocarbons (PAH), produced in laboratory. The samples have been studied by transmission techniques (Borghesi et al., 1987, Blanco et al., 1988a) and more recently by Raman spectroscopy (Blanco et al., 1988b).

In fact Raman and IR active vibrational modes are complementary for PAH molecules highly symmetric characterized by an inversion centre of symmetry. Meanwhile Raman and IR spectra can be very similar in presence of a not very symmetric vibrational force field. This last case applies to PAHs clusters and carbon particles which always occur in chain-like structures.

Raman spectra of different types of graphite have been already studied by Tuinstra and Koenig (1973), and Raman techniques have also been applied to the study of atmospheric pollution by carbonaceous materials (Rosen and Novakov, 1978). However a systematic analysis of carbonaceous materials of astrophysical relevance has not yet been carried out.

We present here updating results of Raman measurements performed on several carbonaceous materials, chosen according to their astrophysical interest. The measurements have been made by means of a Jobin-Yvon double monochromator HG2S and standard DC electronic. We used the line at 5145 Å of an Ar^+ laser as excitation source.