Title

Fullerenes, graphenes, PAHs in space and the Diffuse Interstellar Bands

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Abstract

C60 was discovered in 1985 from a mass spectrometer peak by Kroto, Curl, Smalley & al,, for which they got the Nobel Prize in Chemistry in 1996. It was then produced in macroscopic quantities by Kratschmer et al in 1990, that allowed to confirm the structure of soccer ball geometry, and started a revolution in research and application, to the delight of chemists, physicists, astronomers, architects and UEFA-FIFA fans. In 1994 Foing & Ehrenfreund reported the discovery of two near IR diffuse bands coincident with C60+ bands.The interstellar bands detected at OHP observatory at 9577 & 9632 A were consistent with C60+ spectra in frozen matrix lab measured in 1992 by D'Hendecourt, Fostiropoulos & Léger & other groups. The DIBs assignment as C60+, largest (and most beautiful) interstellar molecule was celebrated by H. Kroto, and confirmed in subsequent observations (ESO, CFHT, etc.. and recently by latest near gas phase laboratory experiments (Campbell et al 2015). The quest for fullerenes, PAHs and large organics in space and Diffuse Interstellar Bands (DIBs) research has advanced since 20 years. DIB observational surveys, DIB families, correlations and environment dependences, resolved substructures indicative of rotational contours by large molecules. DIBs carriers have been linked with large organic molecules observed in the interstellar medium such as IR bands (assigned to PAHs, with some new bands detected by Spitzer assigned to fullerenes, Cami et al 2010), Extended Red Emission or recently detected Anomalous Microwave Emission (AME). Fullerenes and PAHs have been proposed to explain some DIBs and specific molecules were searched. These could be present in various dehydrogenation and ionisation conditions, for example fully dehydrogenated (Vuong, Foing 2000, Abbink et al 2024), in a form similar to graphenes (Nobel prize Physics 2010). Experiments in the laboratory and in space (on FOTON BIOPAN, ISS EXPOSE, OREO Cubes) allow to measure the survival and by-products of these molecules. New observations from VLT EDIBLES programme (Cox et al 2017, Lallement et al 2018) and from HST STIS (Cordiner et al 2917, 2019) give new information on fullerenes and DIBs carriers. We shall also describe some results from our Leiden DIBs group and EDIBLES collaboration .

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