

Laboratory experiment analogous to interstellar carbon dust and its infrared spectrum analysis

*Norio Ota¹, Aigen Li², Laszlo Nemes³, Masaaki Otsuka⁴

1. University of Tsukuba, 2. University of Missouri, 3. Hungary academy of science, 4. Kyoto University

Soccer ball like carbon molecule-fullerene C60 is well studied as a candidate of interstellar carbon dust. Also, it is well known that fullerene could be synthesized by plane graphene molecules. This study tried the analogous laboratory experiment to find specified carbon molecules in space. On the occurrence of star explosion, high energy light seriously illuminates and modify carbon dust. In our experiment, Nd:YAG laser illuminated bulk graphite. Ablated carbon cluster was analyzed by the infrared spectrometer as resulted in figure (A). Infrared spectra (IR) of candidate molecules are compared by the quantum-chemical calculation. Among them, graphene C23 having one carbon pentagon combined with six hexagons shows the resemblance with laboratory experiment as illustrated in (B). Graphene with a void defect would be thermally peeled from bulk graphite. Astronomical spectra obtained in planetary nebulae Tc1 and Lin49 are shown in the figure (C), which result very good coincidence with calculated IR of C23, also rough coincidence with the laboratory experiment. Also, it should be noted that well observed bands at 18.9 and 17.4 micrometer in many planetary nebulae are well reproduced by C23. This study pointed out that graphene is an important component of carbon dust.

Keywords: Interstellar dust, graphene, fullerene

