

# Analysis of Interstellar Infrared Spectrum by Hydrocarbon and Pure Carbon Molecules

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Interstellar infrared spectrum show ubiquitous bands due to polycyclic aromatic hydrocarbon (PAH). However, there was no identification of specific PAH. In this study, we could reproduce spectrum using one or two PAHs by the quantum chemistry calculation. Chemical evolution model is that carbon void was created by high speed proton attack, and that molecule was ionized by high energy photon irradiation.

## Result-1, Hydrocarbon molecule

Starting molecule was coronene (C<sub>24</sub>H<sub>12</sub>). By a void creation and photoionization, coronene transformed to cationic PAH (C<sub>23</sub>H<sub>12</sub>)<sup>n+</sup>. Comparing with ubiquitously well observed spectrum and calculated one of di-cation (C<sub>23</sub>H<sub>12</sub>)<sup>2+</sup>, we could find very good coincidence as follows (1).

Observed wavelength (micrometer): 3.3, 6.2, 7.7, 8.6, 11.2, 12.7

Calculated wavelength (micrometer): 3.2, 6.3, 7.7, 8.6, 11.2, 12.7

## Result-2, Pure carbon molecule

Recently, unusual spectrum was observed in NGC1316 and NGC4589 (2). There are no clear distinct peaks in shorter wavelength. Cause of shorter wavelength band is C-H stretching mode. It is reasonable that molecule may have no hydrogen, that is, may be dehydrogenated. Pure carbon cationic molecules should be calculated. Result of di-cation (C<sub>23</sub>)<sup>2+</sup> show best coincidence as follows (3).

Observed wavelength (micrometer) : 11.3, 12.8, 14.0, 15.6, 17.2, 19.0

Calculated wavelength (micrometer): 11.3, 13.0, 14.0, 15.6, 17.0, 19.0

We could explain variation of observed spectrum by a combination of above mentioned hydrocarbon and pure carbon molecules.

## References

- (1) Norio Ota, arXiv.org 1703.05931 (2017)
- (2) B. Asabere et al, arXiv.org 1605.07651 (2016)
- (3) Norio Ota, arXiv.org 1708.08043 (2017)

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