

Reproduction of Young Star's Infrared Spectrum by Acenaphthylene (C₁₂H₈) Molecule

*Norio Ota¹

1. University of Tsukuba, Graduate school of pure and applied sciences

Recently, infrared spectra of new born young star were studied and listed (1). Among 53 examples, half one show well observed bands and could be reproduced by previously identified coronene (C₂₄H₁₂) based molecules (2) (3). On the other hand, rest half show unusual behavior. In this study, carrier molecules of such unusual spectrum were identified by the quantum chemical calculation. Chemical evolution model is applied to phenalene (C₁₃H₁₀), which would be modified to acenaphthylene (C₁₂H₈) through a void creation by high speed proton attack.

Result-1 HD144432: Model molecule is acenaphthylene (C₁₂H₈). By high energy photon irradiation, molecule became cation (C₁₂H₈)_n⁺ (n=0, 1, 2, and 3). Compared with an observed spectrum of HD144432 and calculated result of di-cation (C₁₂H₈)₂⁺, they show very good coincidence as follows,
Observed wavelength (micron): 8.3, 9.2, 10.0, 11.3, 14.0, 14.6
Calculated wavelength(micron): 8.2, 9.2, 9.9, 11.3, 14.0, 14.6

Result-2 HD37357: Spectrum of this young star is very complex. Looking carefully calculated results on every cationic state, it was found that a suitable combination of di-cation (A) and tri-cation acenaphthylene (B) could reproduce observed feature as follows,
Observed wavelength (micron) : 6.3, 7.5, 7.8, 8.2, 8.6, 9.2, 10.0, 11.2, 14.0, 14.6
Calculation of (A) (micron)..... : 6.1, ---, ----, 8.2, 8.6, 9.2, 9.9, 11.3, 14.0, 14.6
Calculation of (B) (micron)..... : 6.3, 7.4, 7.8, -----, ---, -----, ---, 11.1, -----, 14.6

It should be noted that acenaphthylene has a similar skeleton with biological basic molecules and has a potential of capable resource for Life.

References

- (1) B.Acke et al, The Astrophysical Journal, 718:558 (2010)
- (2) Norio Ota, arXiv.org 1703.05931 (2017)
- (3) Norio Ota, arXiv.org 1709.04560 (2017)

Keywords: interstellar dust, infrared spectrum, PAH