[JJ] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS09]Origin and evolution of materials in space

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Recent progresses of astronomical observations, laboratory experiments, solar-system exploration, and theoretical work have enabled us to attempt to understand the origin and evolution of materials (dust and gas) in space in the context of material science. It is thus important to link further planetary material science and astronomy for comprehensive understanding of dust and gas in space and their role in evolution of galaxies, stars, and planetary systems. In this session, based on latest results on observations, experiments, planetary missions, and theoretical studies on materials in space, we discuss next steps in science for materials in space.

[PPS09-P02]Reproduction of Young Star's Infrared Spectrum by Acenaphthylene (C12H8) Molecule

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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)