Astrochemistry: Recent Successes and Current Challenges
Poster Book IAU Symposium No. 231, 2005
A. J. Markwick-Kemper, ed.

DOI: 00.0000/X000000000000000X

Refractory carbonaceous material in luminous galaxies: Mid-IR spectroscopic constraints

J.V. Keane, Y.J. Pendleton, L.J. Allamandola [1]

[1] NASA-Ames Research Center, Space Sciences, MS-245-3, Moffett Field CA 94035, USA
email: jkeane@mail.arc.nasa.gov

Abstract. Mid-infrared spectroscopy of dusty extragalactic material has grown dramatically in the past years because of the observations from the Infrared Space Observatory and more recently from Spitzer. Spectra of galaxies dominated by absorption bands in the mid-infrared have become commonplace, and seem to be especially associated with (ultra)luminous galaxies, generally thought to be dusty multiple merger systems. These absorption bands are comparable to absorption bands observed in/toward galactic dense molecular clouds which have long been attributed to molecular ice species. For the galaxies, the main challenge is establishing whether one can unequivocally identify the chemical signatures of these materials given the contribution from both diffuse and dense lines-of-sight, and whether there exist any relationship between the molecular bands in the different galaxies. Previous studies of the extragalactic absorption bands have suggested that the bulk of the 6.0μm absorption band is mainly due to H_2O ice, while the bands at 6.85 and 7.3μm are suggestive of aliphatic carbonaceous material (Spoon et al. 2001, 2002). The aliphatic bands do not seem to vary amongst the different galaxies whereas both the peak position and profile 6.0μm band, on the other hand, vary dramatically from galaxy to galaxy.

In light of the recent Spitzer observations, which are significantly more sensitive and comprised of a substantially larger sample of dust obscured galaxies, we revisit the materials that have been proposed as dust analogs that absorb strongly in the mid-infrared (Pendleton & Allamandola 2002). Here, we conduct a case study on two well known galaxies (NGC 4418 and IRAS 15250+3609) which have strongly absorbed mid-infrared continua, but which have very dissimilar 6.0μm bands. We come to the conclusion that the spectrum of NGC 4418 appears to be predominantly that of hydrocarbon material in the diffuse interstellar medium (i.e. no need for cold ice as suggested in previous studies). IRAS 15250+3609, on the other hand, seems to sample material from both dense and diffuse regions, though the best fits can include large amounts of aromatics or alternatively significant H_2O contribution. Interestingly, the mid-infrared sepctrum of this galaxy is very similar to that of material extracted from the Murchison meteorite, suggesting that the organic component of the generally ISM is universally widespread. Furthermore, we attempt to quantify the fraction of aromatic to aliphatic carbon in the galaxies and compare this to carbonaceous chondrite meteorites.

References

Pendleton, Y.J. & Allamandola, L.J. 2002, *ApJS* 138, 75

Sppon H.W.W., Keane, J.V., Tielens, A.G.G.M., Lutz D., Moorwood, A.F.M 2001, *A&A* 365, L353

Sppon H.W.W., Keane, J.V., Tielens, A.G.G.M., Lutz D., Moorwood, A.F.M 2002, *A&A* 385, 1002