THE CHEMISTRY OF CANDIDATE MOLECULAR ION CARRIERS OF THE DIFFUSE INTERSTELLAR BANDS

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Our group at Colorado has been exploring the diffuse interstellar band (DIB) problem by conducting laboratory experiments to measure chemical reaction rates of molecular ions that have been proposed as DIBs carriers. Our facility consists of a Flowing Afterglow Selected Ion Flow Tube (FA-SIFT), into which we inject ions selected by a quadrupole mass spectrometer which are then allowed to react in the flow tube with neutral species expected to be abundant in the diffuse interstellar environments where the DIBs form. The reaction products are then measured using a second quadrupole mass spectrometer. To date we have focused our attention on PAH cations and carbon chain anions, both of which have been proposed as DIBs carriers. In general we find that PAH cations become hydrogenated by the addition of one or two hydrogen atoms when reacting with atomic or molecular hydrogen, while reaction rates with neutral oxygen and nitrogen typically yield CO and HCN or adducts, again with high reaction rates. We conclude that in the diffuse ISM PAH cations will generally be hydrogenated, so that the protonated forms are the species one should consider as DIBs candidates if PAH cations are viable at all. We find that carbon chain anions, up to C_9^-, are very quickly destroyed by reactions with H atoms and are not chemically viable candidates as the DIBs carriers. Current work, which will be emphasized in this talk, is aimed at measurements of larger PAH cations than previously studied, to see whether the trends already observed continue as we progress to larger species.