HUNTING DOWN THOSE BENDING VIBRATIONS OF LINEAR CARBON CLUSTERS

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Pure carbon chain molecules, C_n ($n = 3, 4, 5, ...$) constitute an elusive but extremely important class of carbon clusters, not only from a spectroscopical point of view, but also from astro-chemical aspects, since many of the interstellar molecules contain carbon chains as backbones. Produced in supersonic jets, these highly reactive molecules can be characterised spectroscopically by their antisymmetric stretching modes in the IR-part of the electromagnetic spectrum. The carbon clusters can also be identified by their energetically low lying bending vibrations which occur in the terahertz region. These low ro-vibrational transitions of pure carbon chains and other centro-symmetric molecules which have no permanent dipole moment, provide a new way for the astrophysical detection of these species in cold interstellar clouds.
Among the various carbon clusters studied, we have detected rather recently the existence of gas phase linear C_{10} and C_8 by IR-tunable diode laser spectroscopy. These molecules show antisymmetric stretching modes at 2074 cm^{-1} and 2068 cm^{-1} respectively. The electronic ground state is a $^3\Sigma$ for even numbered and a $^1\Sigma$ for odd numbered carbon chains. The triplet splittings of rovibrational transitions of even numbered clusters were found to increase with the length of the chains. For C_4 and C_6 the splitting is barely to be seen but clearly resolved in the case of C_8 and C_{10}.

C_3 is so far the only carbon chain cluster which has been precisely investigated by its low bending ro-vibrational spectrum. We present our recent results on highly accurate measurements, which confirm our detection of C_3 near the galactic center in Sgr B2 and data obtained from the ISO satellite recently.