THE ROTATIONAL SPECTRA OF THE CARBON CHAIN ANIONS $C_{2n}H^-$ $(n = 1, 2, 4)$

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Our recent discovery that the carbon chain anion C_6H^- is the carrier of a series of hitherto unidentified rotational transitions towards the carbon-rich circumstellar shell IRC+10216[b], and the detection of this anion in a second standard molecular source, TMC-1[c], prompted us to investigate the related anions CCH^-, C_4H^-, and C_8H^- in the laboratory. Here, we present highly accurate gas-phase measurements of the rotational spectrum of these closed shell anions[de]. Lines of CCH^- and C_4H^- were observed in the millimeter-wave band with a free-space millimeter-wave spectrometer in a dc discharge of acetylene and argon. The rotational spectrum of C_8H^-, and additional transitions of C_4H^-, were recorded in the centimeter-wave band with our molecular beam Fourier transform microwave (FTM) spectrometer. The anions were produced in a discharge of diacetylene heavily diluted in an inert buffer gas. The derived spectroscopic constants allow for the precise determination of rotational line frequencies for astronomical searches throughout the radio band. Based on this work, the C_4H^- anion has now been detected in IRC+10216[f]. The status of a search for C_8H^- in space will be reported.

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