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Measurements of temperature-dependent absorption cross sections of C_2H_2 in the VUV-UV region

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Abstract

Using a synchrotron radiation as a continuum light source, we have carried out laboratory measurements of the temperature-dependent photoabsorption cross sections of C_2H_2 from 120 to 230 nm region at 295 K and from 120 to 215 nm region at 150 K with a spectral resolution of 0.007 nm. In the presently studied spectral region the cross section values vary by 6 orders of magnitude, and the absorption features vary from sharp rovibronic structure, shaded bands, to diffuse bands. High-temperature cross sections of C_2H_2 in the 120–140 nm region has also been measured for the purpose of identifying possible hot bands. The previous assignments of several hot bands in the 130–140 nm region were crucial in the determination of the electronic structure of a valence *E* state. However, we find that the previously assigned hot bands at 135.09 and 136.24 nm are not hot bands at all because they are insensitive to temperature change from 150 to 370 K. The Galileo spacecraft has made incredibly successful observations of the Jovian system including the prominent C_2H_2 auroral features, and the Jupiter flyby of the Cassini spacecraft is yet to come. Equipped with higher-resolution spectrometers, the Cassini mission promises to provide higher scientific returns regarding the Jovian auroral observations. Solar and stellar occultation experiments at Saturn by the Cassini spacecraft will provide more detailed observations of the Saturnian upper atmosphere than ever before. The data presented in the present work are an extension of our effort to provide the required data to the scientific community and will have a significant impact on our understanding of the atmospheres of Jupiter and Saturn, in particular, and other outer planets and satellites, in general.