Study of Higher Excited States of Some Polyatomic Molecules Relevant for Plasma Physics and Environment

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Since the extensive studies of polyatomic molecular spectra by Herzberg [1] and Robin [2] there have not been attempts for systematic research of higher excited states and elucidation of electronic structure that would lead to comprehensive understanding of the behaviour of bound electrons in molecules. However, a tremendous advancement in both experimental methods and theoretical analysis of particular cases became evident trough a number of published papers covering all aspects of complex molecular spectra and their manifolds. On the other hand, the role of electronically excited states of polyatomic molecules had been profoundly investigated when the specific questions had been raised off like the influence of chlorofluorocarbons (CFC) on ozone layer depletion and global warming [3-5], the replacement for plasma etching molecules [6] or radiation damage of DNA deoxyribose analogue molecules [7-10].

Even for triatomic molecules such as H_2O, H_2S, CS_2 and N_2O there are many discussions about the assignment of electronically excited states in terms of valence, Rydberg of mixed character. Electron excitation of the higher states of H_2S molecule will be presented and the tentative assignment will be discussed. A particular interest in this molecule comes from its participation in a great number of processes. It has been recently found in interstellar molecular clouds; it is known as one of the major pollutants of the Earth's atmosphere which gives the origin of corrosive processes in metals; it is used in the synthesis of a semiconductor, tungsten sulphide (WS2); in mixtures with other gases it is used in plasma nitrocarburizing processes. The H_2S molecule has a very strong dipole moment, and its presence in a gas can have significant effects on the physical properties of the gas, first of all on electrical conductivity.

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