MOLECULAR SPECTROSCOPY IN STAR-FORMATION REGIONS, FROM FUTURE SPACE MISSIONS

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During the next decade a tremendous advance will take place in instrumentation for spectroscopy of the interstellar medium. Major new facilities (SOFIA and HIFI/Herschel) will be constructed so that the science opportunities, in the field of astrochemistry, will increase by a huge factor. This will be enhanced by new receivers with greater bandwidth and sensitivity. Line-surveys will be carried out over a THz spectral range, with possibly as many as 10^4 lines detected per scan. In such cases, the line redundancy may allow accurate modelling of the physical and chemical parameters of the medium. Hopefully, these accurate models can be used for analysis of the physical and chemical properties of the less well characterized molecules, which lack laboratory data.

Various aspects of new spectral ranges are discussed, with emphasis on deuterium in molecules. Recently, multiply deuterated species have been detected, e.g. ND_3, in cold dense regions of the interstellar medium. It is possible that sufficient deuterium could be trapped, by the fractionation process, into heavy molecules such as ND_3, etc..., or species such as H_2D^+, that the major reservoirs of deuterium, D and HD, might be depleted. Light molecules (hydrides and deuterides) generally have large fundamental rotation frequencies, often lying in the HIFI, submillimeter and THz bands. The deuterides are a specially suitable case, because they exist mainly in cold dense regions, where the molecules are in the ground states and submillimeter and THz observations will best be carried out by absorption spectroscopy against background dust continuum sources such as Sgr B2.

Key words: ISM: molecules - Astrochemistry - Deuterium - Submillimeter