DIFFUSE INTERSTELLAR ABSORPTION AND EMISSION BANDS

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The diffuse interstellar absorption bands are observed in spectra recorded towards stars that are partially obscured by interstellar dust. Their origin is the longest standing problem in astronomical spectroscopy, dating back to the 1930s when systematic study of the bands first started. The absorptions are known as diffuse bands because their widths are greater than those arising from transitions in known atoms or molecules along the same lines of sight. There has been an ongoing controversy as to whether the carriers are free gas phase molecules or are associated with the dust grains which cause the extinction of starlight. Evidence in favour of molecules as carriers has grown in recent years and includes the invariance of the absorption wavelengths and narrowness of some of the bands, the lack of polarisation structure across a band, and discovery that some of the diffuse bands are seen in emission from a peculiar nebula, the 'Red Rectangle', and an RCr B star V854 Cen. The various proposals for the carriers are reviewed together with an assessment of laboratory experiments.

Recent observational work is described including wavelength and spatially resolved 'diffuse band' emission from the Red Rectangle, complementary recordings of the 3.3 μm 'unidentified' infrared emission band, and ultra-high resolution absorption spectra of some of the narrower diffuse bands. In each case the data carry clues as to the nature of the carriers and provide indications of useful directions which may be pursued towards an assignment. The high resolution absorption data show fine structure which is of sufficient quality to allow rotational contour fitting of the profiles and determination of molecular parameters consistent with the spectra.

INFRARED EMISSION SPECTROSCOPY AND MOLECULAR ASTRONOMY

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We have found high resolution infrared emission spectroscopy to be a very powerful technique. Even at long wavelengths in the far infrared region, excellent spectra of hot transient molecules are obtained. Exemplary spectra of the molecules CuH, SiO, C_{60}, LiH and polycyclic aromatic hydrocarbons will be shown. The talk will have an astrophysical theme and will include many astronomical spectra. Applications of laboratory emission spectroscopy range from the discovery of hot water vapor in the sunspots to the characterization of thin films.