SPECTROSCOPY OF THE HEAVENS

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The last twenty-five years or so have witnessed a revolution in our understanding of the molecular make-up of the universe. Using a variety of the tools of molecular spectroscopy, astronomers have discovered that molecules can be found in a wide variety of regions in space and are excellent indicators of the physical conditions of these sources. In the millimeter-wave region of the spectrum, astronomers have detected the high-resolution rotational spectra of numerous gas-phase molecules through 13 atoms in size. The molecules are found chiefly in dense interstellar clouds, which are giant regions of gas and tiny dust particles located among the stars. In the infra-red, both gas-phase molecules and molecular ices on the surfaces of dust particles have been identified in interstellar clouds, and there is strong evidence that carbonaceous molecules known as polycyclic aromatic hydrocarbons are almost ubiquitous in interstellar space. In the visible, there remain a large number of unidentified spectral lines which may indicate the presence of exotic molecules such as carbon anion chains.