

Matter between the stars

The space between the stars is far from empty. Although it is a far more perfect vacuum than any we could create on Earth, the minute amounts of matter present – less than 1 atom per cm^3 on average – begin to add up across the vast gulfs which separate the stars. Optical and ultraviolet astronomers see these effects in the spectra of distant stars as thin absorption lines: lines caused by atoms of calcium (Ca), potassium (K), sodium (Na) and iron (Fe) in space. Broader absorption lines of unknown origin, the **diffuse interstellar bands**, also cross the spectra

of remote stars. Radioastronomers can tune into a cacophony of broadcasts from the matter between the stars, each telling a different part of the story. Those near 21-cm wavelength tell of the distribution of cool hydrogen gas (H I) in space; while a radio astronomer listening in between 300 m and 3 mm will learn of the convoluted paths travelled by cosmic ray electrons. Also, X-ray, γ -ray and cosmic ray researches all have their part to play in unravelling the structure of the interstellar medium. Surveys by future spacecraft similar to COS-B (gamma-rays) and Einstein (X-rays) should be of the greatest value in this particular field.

This all-sky photograph of the Milky Way reveals how the dust grains clump along the plane of our Galaxy.

