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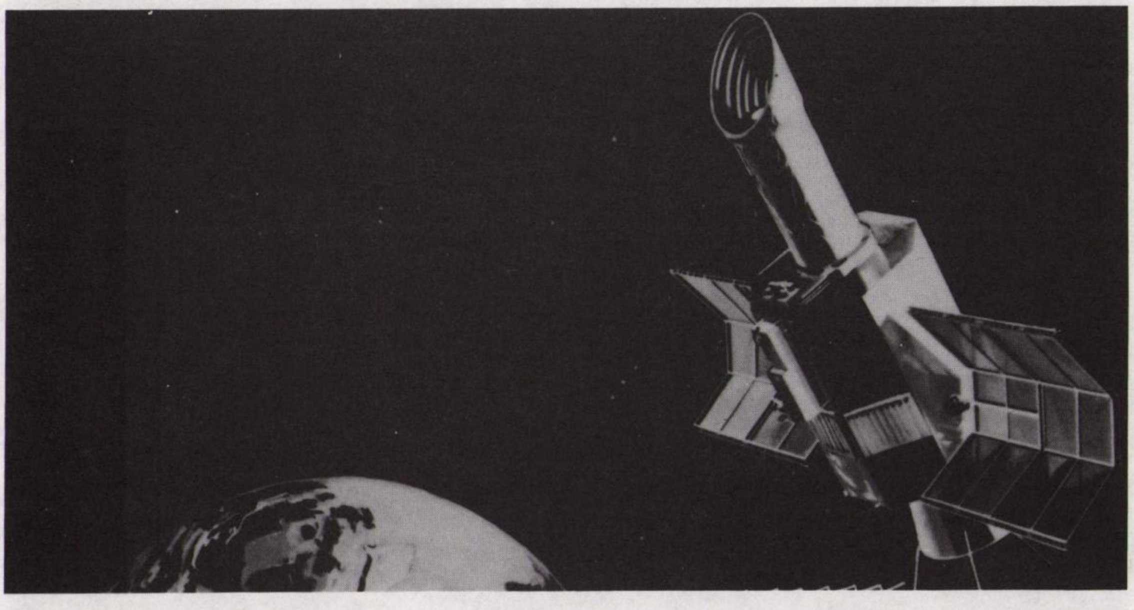
THE INTERNATIONAL ULTRAVIOLET EXPLORER

Until the middle of the last century, virtually all our knowledge of the Universe came from studying the positions and brightness of the myriad points of light scattered across the sky. It was only when the *spectroscope* was developed to allow the analysis of the light itself that the great stride forward into understanding the nature of those sources of light became possible. For contained in the *spectrum* of a star, nebula or galaxy is a wealth of information not only on the physical conditions of temperature, pressure and composition, but also on the dynamical state.

This spectrum, however, is not just the familiar rainbow of colours produced by the dispersion of sunlight in raindrops; it extends to much more energetic radiation - Gamma rays, X-rays and ultraviolet light - and to lower energy radiations - infrared, microwaves and radio waves - all of which are invisible to our eyes. But they all carry valuable information about the Universe around us. Fortunately for life on Earth - but unfortunately for astronomers, many of these radiations are blocked by the Earth's atmosphere and to make observations requires telescopes placed well above it.

In the case of *ultraviolet light*, astronomers have been observing the stars for many years using rockets, balloons and satellites. However, for the last 12 years, the science has been dominated by *The International Ultraviolet Explorer*, in terms of research productivity, the most successful astronomy satellite to date. Conceived in Britain, *IUE* carries a telescope with an 18-inch diameter beryllium mirror which feeds light to one of two *spectrographs* on board where the light is spread out into a spectrum. This can be done with *high or low dispersion* depending upon whether one wishes to study the fine detail in a relatively bright object or to record the grosser features in the spectrum of a faint one. The two spectrographs cover the wavelength range 115 - 200 nm with resolutions of 0.015 or .6 nm. The images are recorded on SEC Videcon cameras which were developed in Britain.



IUE was placed in *geosynchronous orbit* following its Delta launch on 26 January 1978. It is a collaborative project between NASA, ESA and SERC and the satellite is operated for 24hrs a day, 16hrs going to American observers who conduct their science from the Goddard Space Flight Center in Maryland, and 8hrs a day going to European astronomers who visit the ESA tracking station near Madrid to carry out their observations. These observations are conducted with real-time interaction from the observer, who can select his target, decide on the duration and resolution mode of his exposure, and inspect the data soon after it is read down from the satellite. In over 12 years of operation, over 70,000 spectra have been collected and about 2000 scientific papers using *IUE* data published in major journals, not to mention nine *IUE*-dedicated conferences. The large user community results not only from the longevity of the spacecraft, which was expected to last for 3 - 5 years, nor the interactive mode of operation, which gets the astronomer involved with his observations in a way few other satellite projects have done, nor even the richness of the ultraviolet spectrum for so many celestial sources, but in good measure from the policy of making the archive of data freely and easily available to the **whole** community just six months after the data has been taken. This means that a large number of research projects have been made possible without recourse to new observations.

IUE has touched upon almost every area of modern astronomy. In *Solar System studies*, the major planets have been observed with important new results on the interaction between Jupiter and its moon Io, asteroids have had their ultraviolet reflectivity, which depends on surface material, measured, and numerous comets have been watched as they approach the Sun and then race back into deep space releasing gases from their icy surfaces.

For cool stars like the Sun, *IUE* has thrown important new light on the *structure of the chromosphere and transition region* which surmount the visible photosphere. Such work is vital for studies of solar-type activity (sunspots, solar wind, flares, etc), knowledge of which is of concern in understanding our Sun. For hot stars, where much of the radiant energy emerges in the ultraviolet, *IUE* has made essential contributions to investigations of stellar evolution because of its ability to record the emission of radiation and also *mass loss* from the stellar surface.

Between the stars are thin but vast clouds of gas and dust and *IUE* has been put to good use probing this *interstellar material* by recording the characteristic spectral features of many chemical elements imposed on light from background stars as it passes through the clouds.

Finally, on the grandest scale, whole *galaxies* have been observed, many of them with extremely energetic events going on in their nuclei, probably powered by material falling into massive black holes. *IUE* has helped to study these processes by allowing the observation of important diagnostic spectral features and the energy distributions of these *active galactic nuclei.*

Although showing the signs of old age, astronomers throughout the world hope that *IUE* can continue to yield valuable data for several years to come.

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