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RUTHERFORD APPLETON LABORATORY

SCIENCE AND ENGINEERING RESEARCH COUNCIL

Lyman-FUSE : The Far Ultraviolet Spectroscopic Explorer

For many years, British scientists have played a major role in ultraviolet (UV) astronomy. Beginning with instruments on sounding rockets, balloons and eventually satellites, the UK has earned international recognition for the quality of its UV research. For more than a decade this work and also worldwide UV astronomy has largely depended on a satellite called IUE (International Ultraviolet Explorer).

In 1988, the UK IUE project team together with NASA and the European Space Agency were awarded the 1988 Presidential Award for Design Excellence, by President Reagan.

In 1989, following talks with NASA, it was agreed that certain key elements in a new UV satellite instrument, to be known as Lyman-FUSE, would be manufactured jointly by Canada and the UK. NASA will build the rest of the instrument and has overall responsibility for the mission.

The far UV spectral window opened up by Lyman-FUSE will provide unique access at unparalleled sensitivity to many critically important atomic and molecular species. Most of the resonance lines of the most chemically abundant species in a wide range of ionisation states fall within Lyman's spectral window, providing measurements of gas and plasma in the universe at temperatures from a few tens of degrees to over 10 million degrees. Lyman-FUSE will provide crucial observations of objects as diverse as planetary magnetospheres, the interstellar medium, stars of all types, active galaxies and quasars and the inter-galactic medium.

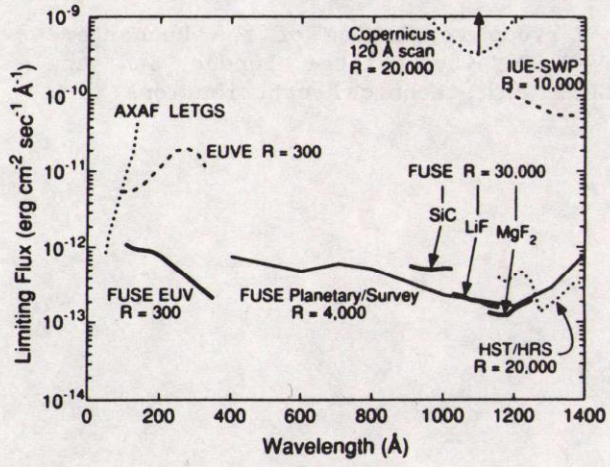

Figure : 1
The sensitivity of Lyman-Fuse compared with other UV and EUV missions
(From the NASA Phase A study final report)

Lyman-FUSE, to be launched in 1996, will provide spectroscopy of astronomical objects in the far UV spectral range from 900 to 1250 angstroms, at the very high resolving power of 30,000. Only the NASA Copernicus mission, in operation from 1973-79, has observed the far UV region before, and was limited to 'naked eye' stars (Figure 1). By comparison, Lyman-FUSE has a sensitivity of 100,000 times that of Copernicus and will measure, for the first time, sources throughout our own galaxy and at very large extra-galactic distances.

The high sensitivity of Lyman-FUSE is achieved with a 70 cm. grazing incidence primary Wolter-II telescope feeding a highly efficient Rowland spectrograph with photon counting electronic detectors (Figure 2). In addition to the high-resolution far UV capability, Lyman-FUSE will also carry a medium resolution spectrograph (resolving power about 300 - 600) covering the extreme UV range from 100 to 900 angstroms and other resolving powers will be available. This instrument will provide detailed spectroscopy of sources discovered in the first extreme UV sky survey to be carried out by the UK Wide-Field Camera on the ROSAT satellite.

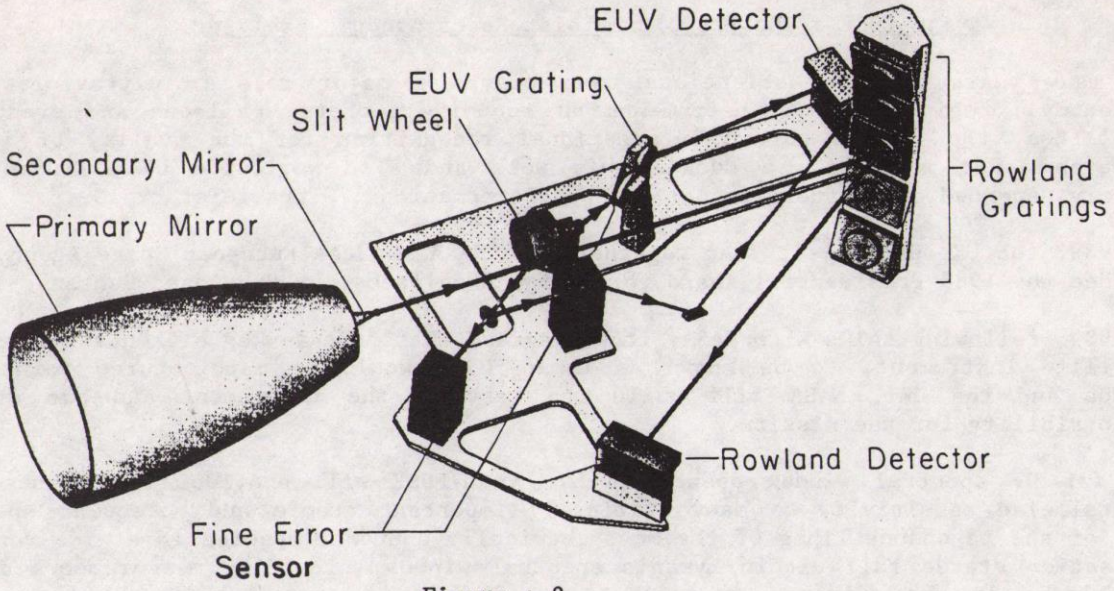

Figure : 2
Schematic view of the spectrograph optical components
(From the NASA Phase A study final report)

Within the UK, work will be carried out by a group consisting of the Rutherford Appleton Laboratory, Birmingham University, University College London and the Mullard Space Science Laboratory (part of UCL), with technical contributions from industry.

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