A Search for Interstellar Be II λ 3130: CASPEC Shakes Hands With IUE and GHRS

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The wavelength region near the atmospheric high-frequency cut-off is still a considerable challenge for high-resolution spectroscopy. The sensitivity of both IUE and GHRS on HST drops steeply at wavelengths where atmospheric absorption still is a substantial handicap for ground-based observers. The situation is even worse if signal-to-noise ratios considerably in excess of 100 are also required and which are not within easy reach of either IUE or GHRS.

Scientific Background

One of the most interesting spectral features in this domain is the strongest line of Be II at 3130.4 Å (in most of the relevant astrophysical environments, the singly ionized atom will by far be the dominant ionic species). With atomic number 4, this element is just at the limit where some non-standard big-bang model calculations predict traces of primordial abundances (e.g., Boyd, R.N., Kajino, T.: 1989, *Ap. J. (Letters)* **336**, L55). The main source of beryllium is probably the spallation by cosmic rays of heavier nuclei in the interstellar medium. Knowledge of the efficiency of the spallation process and the concomitant depletion onto dust grains is very essential for assessing the primordial abundance of lithium, the element which is the most important cosmological diagnostic. In stars, beryllium is quickly destroyed at temperatures above about 3.5×10^6 K. It can, therefore, be expected to be seen only in cool stars where, so far, crowding in the 313-mm region has permitted only upper limits to be determined (e.g., Ryan, S.G., Bessel, M.S., Sutherland, R.S., Norris, J.E.: 1990, *Astrophys. J. (Letters)* **348**, L57; Rebolo, R., Molaro, P., Abia, C., Beckman, J.E.: 1988, *Astron. Astrophys.* **193**, 193).

Also in the interstellar medium, only upper limits have so far been obtained (Boesgaard, A.M.: 1985, *P.A.S.P.* **97**, 37). They suggest that from space the best strategy would presently be to go to fainter sources with large column densities which can be detected even at relatively low S/N. By contrast, there seems to be a niche for ground-based efforts if a large light-collecting area is combined with a low-noise detector. The best upper limits on the equivalent width of interstellar beryllium lines (down to 0.23 mÅ) have, in fact, resulted from observations from the ground (Boesgaard, op. cit.).

Observations

For the detection of isolated spectral features, a spectral resolution, $\Delta\lambda$, roughly equal to the line width is close to optimum. This would have made the CES the instrument of choice. However, towards the UV, the high-efficiency multi-layer coatings of the optical surfaces of the CES have an extremely steep fall off in throughput which sets in at wavelengths noticeably longer than 3130 Å. Therefore, our only chance was to submit an application for observing time with CASPEC. We were allocated two nights in May 1990.

We used CASPEC with the 31.6 lines/mm echelle grating (which has twice the efficiency of the 51.6 lines/mm grating in the UV), the Long Camera (which provides a better sampling, i.e. reduces the effect of small-scale detector blemishes and facilitates the definition of order and inter-order space), and a coated (for higher UV response) GEC CCD (ESO No. 7) which has 576×385 pixels of 22×22 μm. With this configuration, we