THE WIDTH OF ECHELLE ORDERS IN IUE IMAGES
as derived with the
ASTRONOMICAL IMAGE DISPLAY- AND ANALYSISSYSTEM (AIDA) IN TÜBINGEN

As is known since the launch of the IUE and the production of the first high dispersion spectra at the IUE Observatories, the crowding of the orders towards the shorter wavelengths causes difficulties in properly defining the background in the images. In the spectra, the (saturated) cores of interstellar lines, e.g. in SWP shortward of 1300A, reach intensities of some 20% below the continuum values of the spectrum. This is due to the difficulty to select pixels in the interorder space representing the true background of the image, with no contributions from the ajacent echelle order signal at all.

With the AIDA in Tübingen we have investigated the shape and location of the echelle orders in IUE images. With AIDA, extractions can be performed in (IUE) images with all parameters left to be choosen by the user. Not only are start and end point of an extraction free, but also slit-width and -height as well as orientation can be selected at the spot. The intensity found for each slit position is the sum of the fractional pixel values within the slit. We have surveyed a few images of each camera to determine the width of the echelle orders (perpendicular to the dispersion). We found that the shape can be approximated sufficiently well (for practical purposes) by a gaussian. This shape is the same as that found in low-dispersion IUE images (see de Boer and Meade, 1981, NASA IUE Newsl 15, p53) and was known before launch (Coleman et al 1977, IUE Technical Note 31, Univ. College London).

Using the known shape, in principle a three-gauss fit can be made at each location in the IUE echelle image. Doing so, the amount of the contribution from the adjacent orders to the pixels pertaining to the central order can be set. In this way, all undesired contributions to the spectral intensity to be extracted can be eliminated at once. Within the AIDA we have choosen a simple solution for the software doing such proper extraction. Since the effect of the wrong background is most notable for interstellar lines (for the large scale stellar continuum the wrong background is sort of calibrated out in the IUE high-dispersion ripple and photometric calibration), the extraction routine of AIDA was designed to work on a limited portion of an echelle order. Having set begin and end points for the extraction, the program defines a strip with a height of a little more than twice the local separation of the orders. This strip is subdivided in 50 bins along its height, and the data are summed in the direction parallel to the order, thus producing a 50 element mean cross-profile, containing the three orders under concern. In this a three gauss fit is performed. The background value found is the mean over the length of the strip. Since the background varies only slowly along the order, the use of this mean causes only small deviations from the true background at both ends of the strip. The spectral intensities are now obtained by summing the information in an extraction slit of a height of only 1 SIGMA on either side of the location of the central order. It can be shown easily that in this way 68% of the information of this central order is collected in the slit, WITHOUT contribution from the adjacent

orders (actually less than 0.5%). We note that the use of this very short slit requires careful positioning of the start and end points before extracting.

The new IUE Observatory software without geometric correction implemented about a year ago (Nov 1981 at NASA, Mar 1982 at ESA) has brought some improvements in this sense (Bohlin and Turnrose, NASA IUE Newsl 18, p29). In that software the height of the extraction slit is now also a function of the order separation, but is still substantially taller than the AIDA slit. The problem of the interorder level remained unaltered.

The AIDA program was written for a PDP11/34+FPS-array processor combination. A full account is in print in Astronomy and Astrophysics. This note was prepared upon the request of the Editor of the NASA IUE Newsletter.

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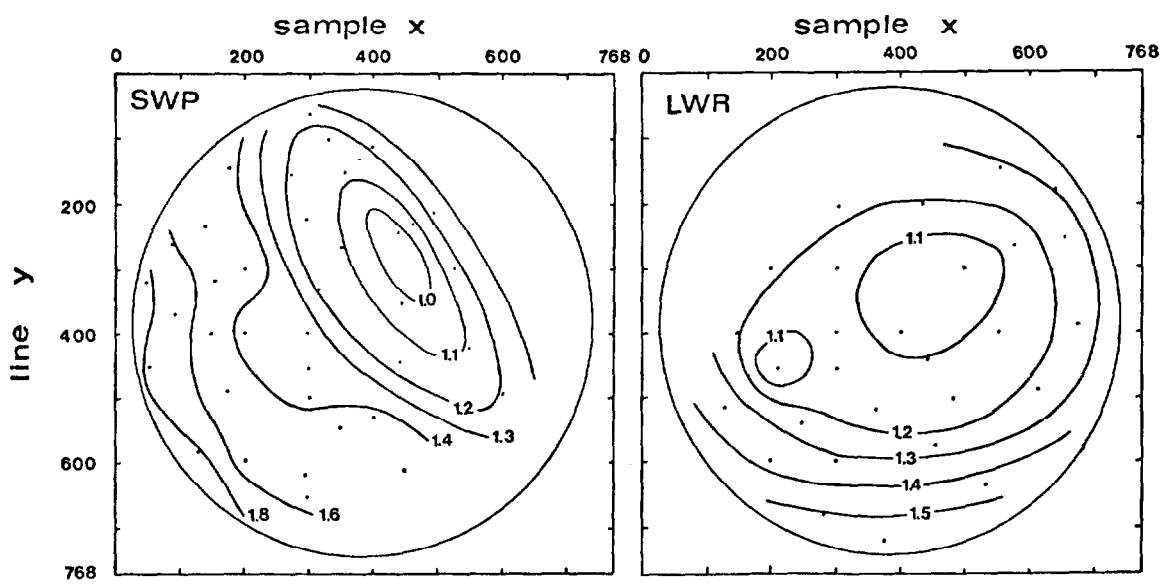

Under the assumption that the point spread function of IUE echelle spectra is gaussian, values of SIGMA have been derived at various locations (dots) in both SWP and LWR images, using algolrithms developped for the Astronomical Image Display- and Analysissystem (AIDA) in Tübingen. The contours show the mean values from three geom-gphot images each, in units of 1 (linear) pixel. For areas with usually low signal the sigmas have uncertainties larger than 10%. This figure is Fig 4 of de Boer, Preussner and Grewing, Astron. Astrophys. , in press.