

# Spatial distribution of interstellar reddening

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**Abstract:** Since the work of Neckel & Klare (1980) who studied the distribution of interstellar extinction with distance in 325 fields, only a few more selected fields have been investigated for the determination of absorption with distance.

Another complete study (Arenou, Grenon & Gómez 1992) of extinction has been done in preparation of Hipparcos data to estimate the exposure time needed for every star, dividing the sky in 199 cells and computing for each cell an analytical expression of the  $A_V$  ( $R, I_{II}, b_{II}$ ).

The enormous amount of spectral and photometric data through the Virtual Observatory (OV) or the Strasbourg Astronomical Data Center (CDS), combined with the large number of stars observed by IUE and, in perspective, the future GAIA distance determinations makes it possible now to undertake a very precise study of the spatial distribution of interstellar reddening.

## REDDENING DETERMINATION FROM IUE SPECTRA

The colour excess  $E(B-V)$  will be estimated from the strength of the 2175 Å dust bump taking advantage of the fact that the Galactic extinction curve (e.g. Seaton 1979) takes about the same values around 1700 Å and 2420 Å, as shown in Fig. 1, so that the flux ratio at these wavelengths,  $F(1700 \text{ Å})/F(2420 \text{ Å})$ , is independent of the  $E(B-V)$  value adopted.

We have tested the method with a sample of 357 stars of B spectral types and all luminosities (Morales et al. 2008). The relation of the bump strength with the  $E(B-V)$  obtained from the observed and spectral type intrinsic colours found is the following (see Fig. 3) :

$$E(B-V) = -0.014 + 1.064 * \text{STRENGTH}$$

With an r.m.s. error of 0,085 mag.

Another method, allowing for a more precise determination of  $E(B-V)$ , is based on the comparison of observed fluxes - corrected with different amounts of reddening - with Kurucz model atmospheres (Morales et al. 2009). It consists of an iterative process in which, for any given value of  $E(B-V)$ , the reddening corrected spectrum is compared with a grid of Kurucz model spectra generating a set of corresponding r.m.s. errors (model versus de-reddened). In this way a 'iso-error diagram' can be drawn (see Fig 4).

This method is very reliable for small values of reddening. On the other hand, the first method might fail in presence of noisy spectra.

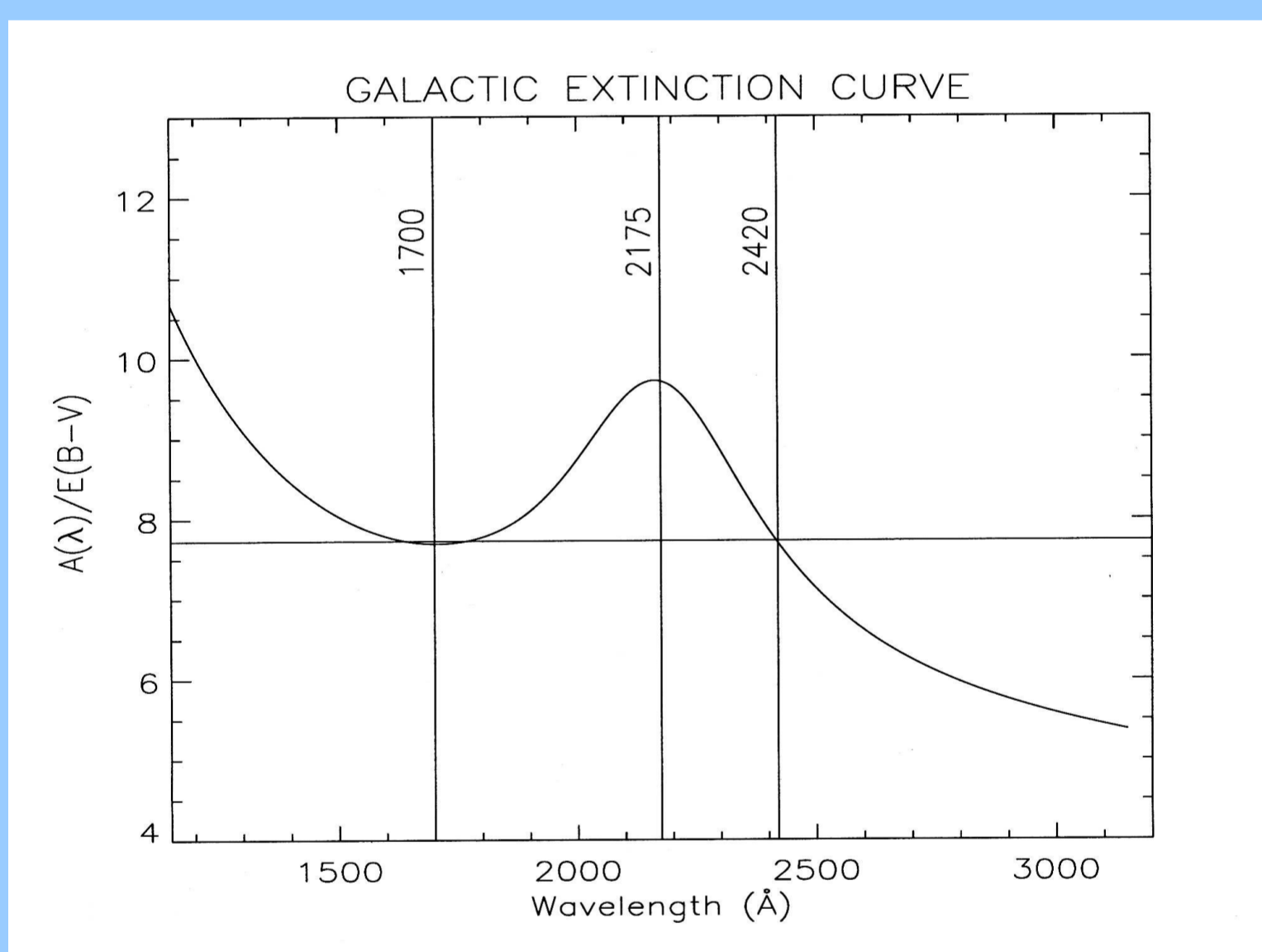


Fig 1: The Galactic interstellar extinction curve (Seaton 1979). Vertical bars indicate the maximum around 2175 Å and the two wavelengths at which the extinction takes about the same value.

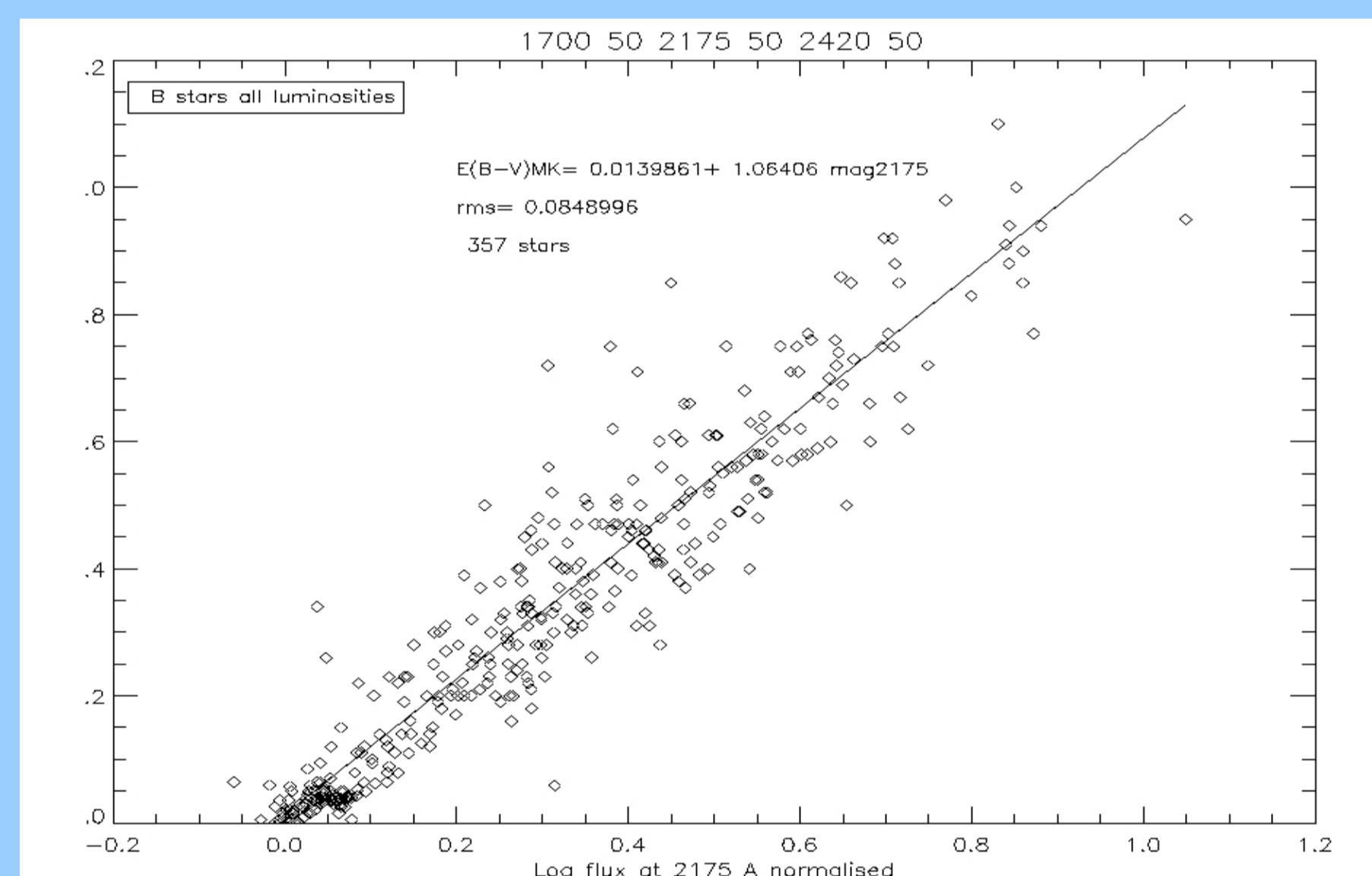


Fig 2: Literature values of  $E(B-V)$  are plotted as a function of the Bump Strength defined above

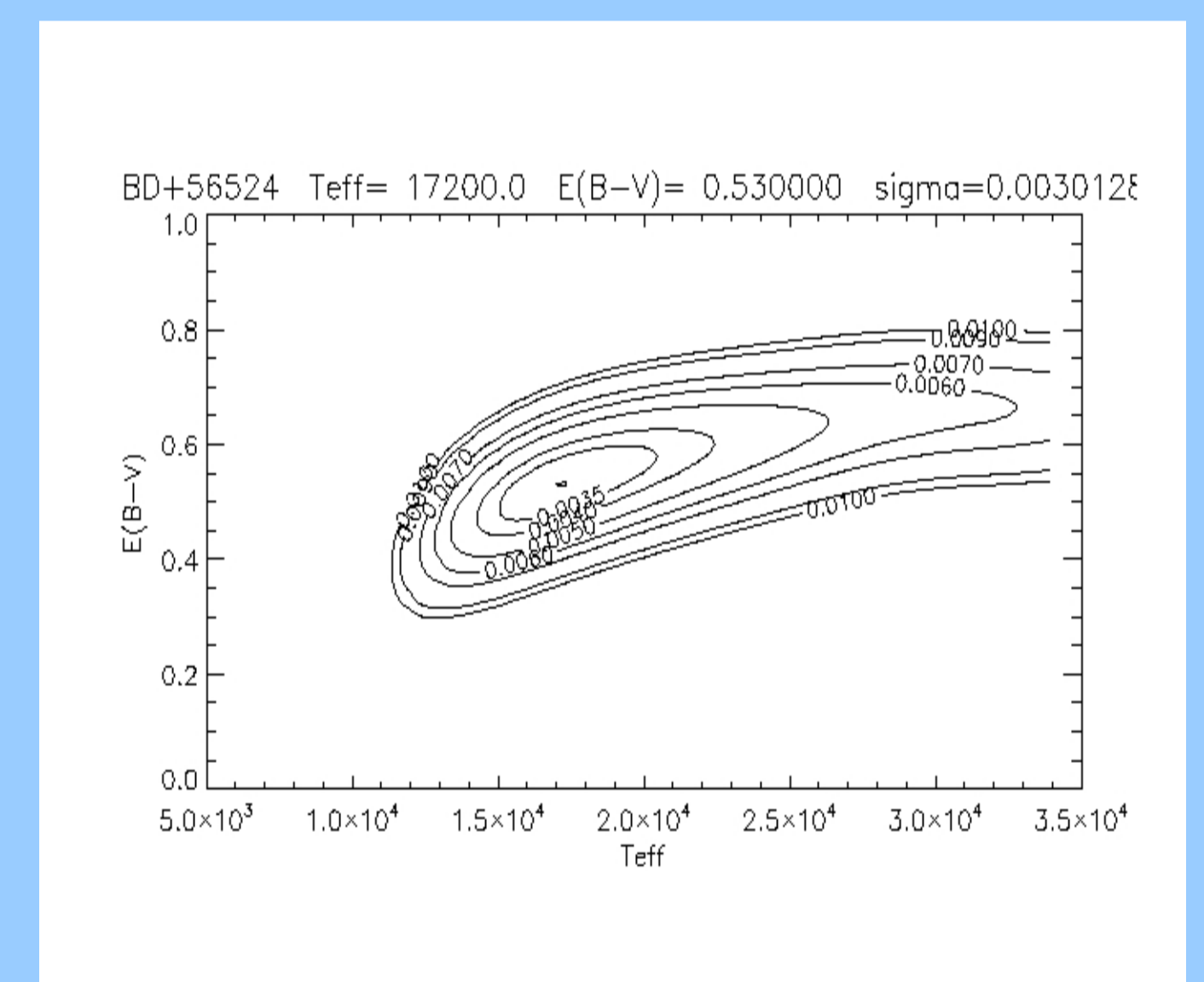


Fig 3: Iso-error diagram for star HD75112. The x and y axes represent the effective temperature of the Kurucz model, and the  $E(B-V)$  colour excess, respectively. The best  $E(B-V)$  value so estimated is 0.04.

## SPACE DISTRIBUTION OF OBSERVATIONS

Roughly 9000 objects have been observed with IUE and are available at the INES Database. Out of them, 860 are Magellanic cloud stars, and 288 are white dwarf stars. Through the combination of colour excess from the two methods above, the  $R_V$  determinations from 2MASS colours (Morales et al. 2006), and Gaia distances it will be possible to study the distribution of absorption as a function of distance in almost all galactic directions, as one can appreciate from the Aitoff projection (shown below) of the galactic coordinates of the stars observed with IUE.

Space Telescope UV observations, and spectra from the future World Space Observatory will be of fundamental importance for this study, especially to explore poorly populated sky directions.

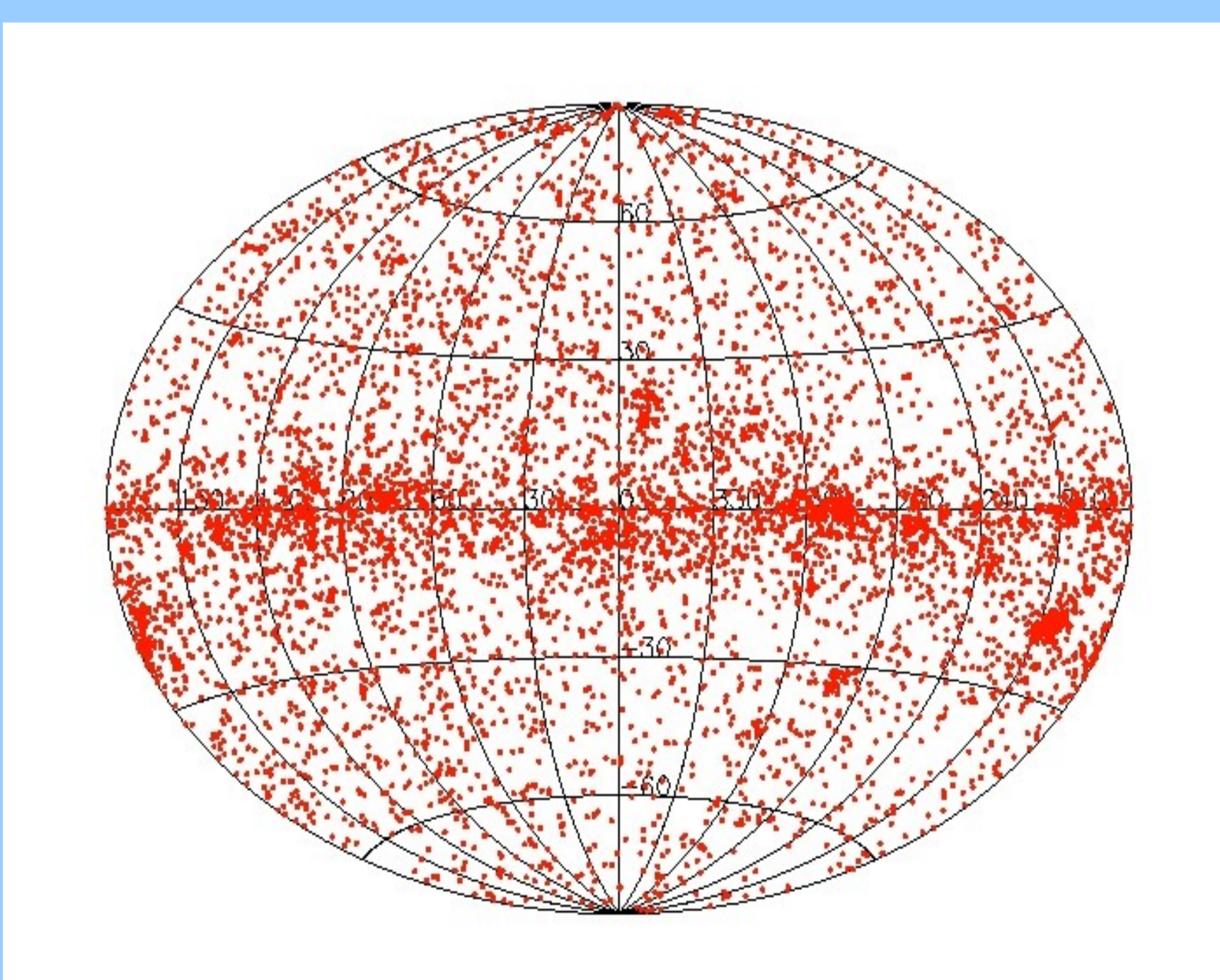


Fig 4: Aitoff projection of the coordinates of all stars observed by IUE present at the INES Database.

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