

# A High-Resolution Study of the Near-Infrared Diffuse Interstellar Bands

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## Summary

Since their initial detection by Heger in 1922, the identification of the carriers of the Diffuse Interstellar Bands (DIBs) has gone on to become one of the longest-standing problems in astrophysics, with several hundred DIBs now having been detected at visual wavelengths. Although the carriers are widely thought to be carbonaceous molecules/ions, an unambiguous carrier identification for most of the bands remains elusive. One strong observational constraint on the nature of the carriers, however, is the detection of DIB substructure via high-resolution echelle spectroscopy.

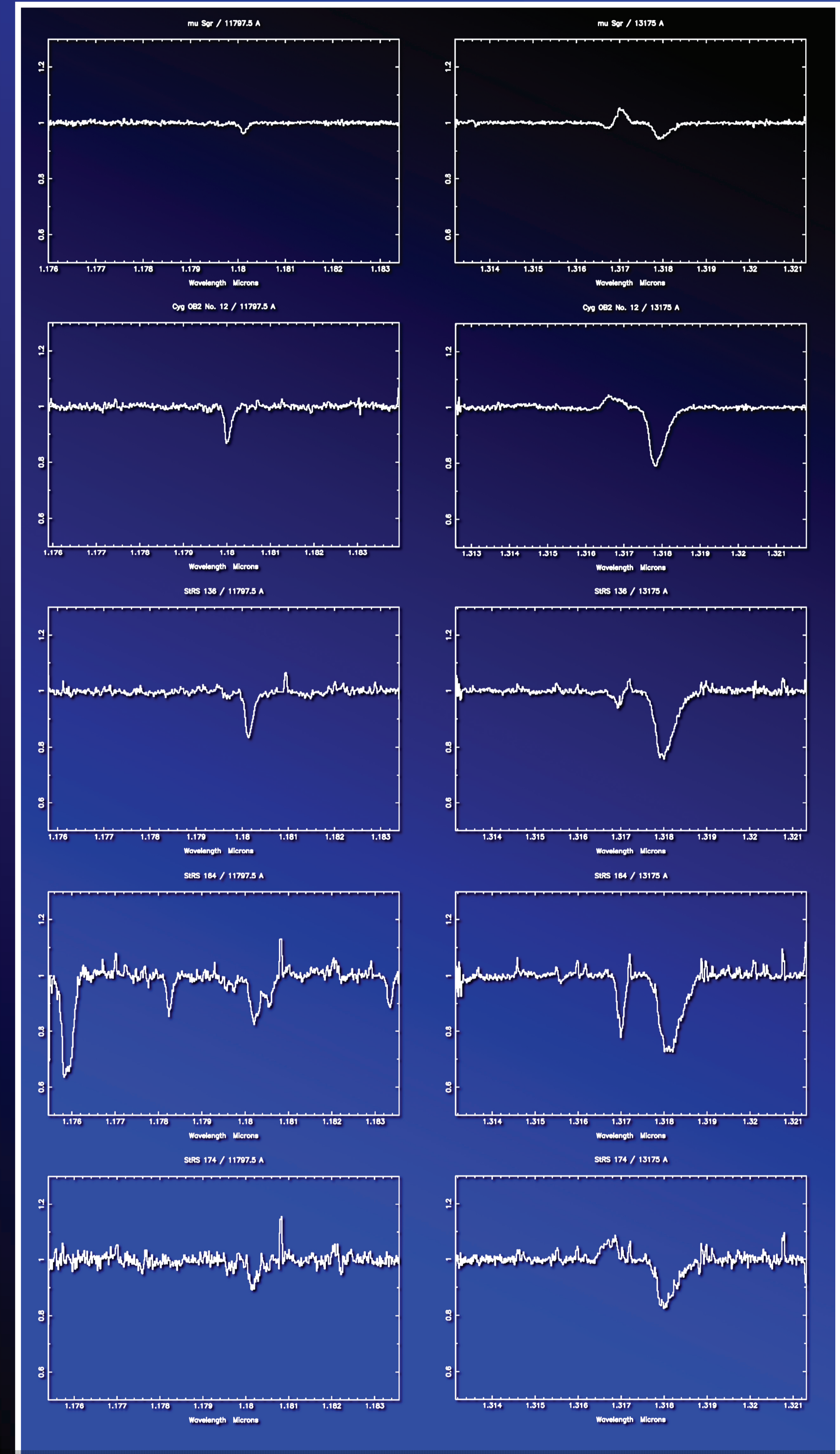
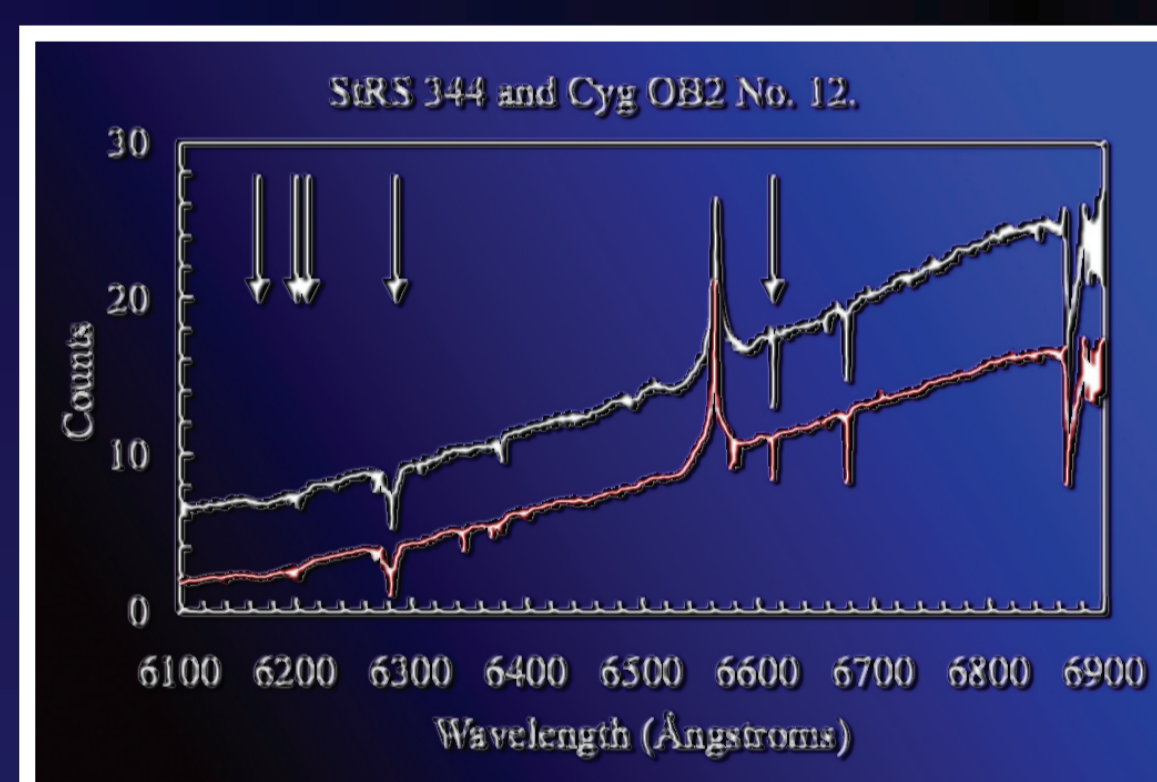
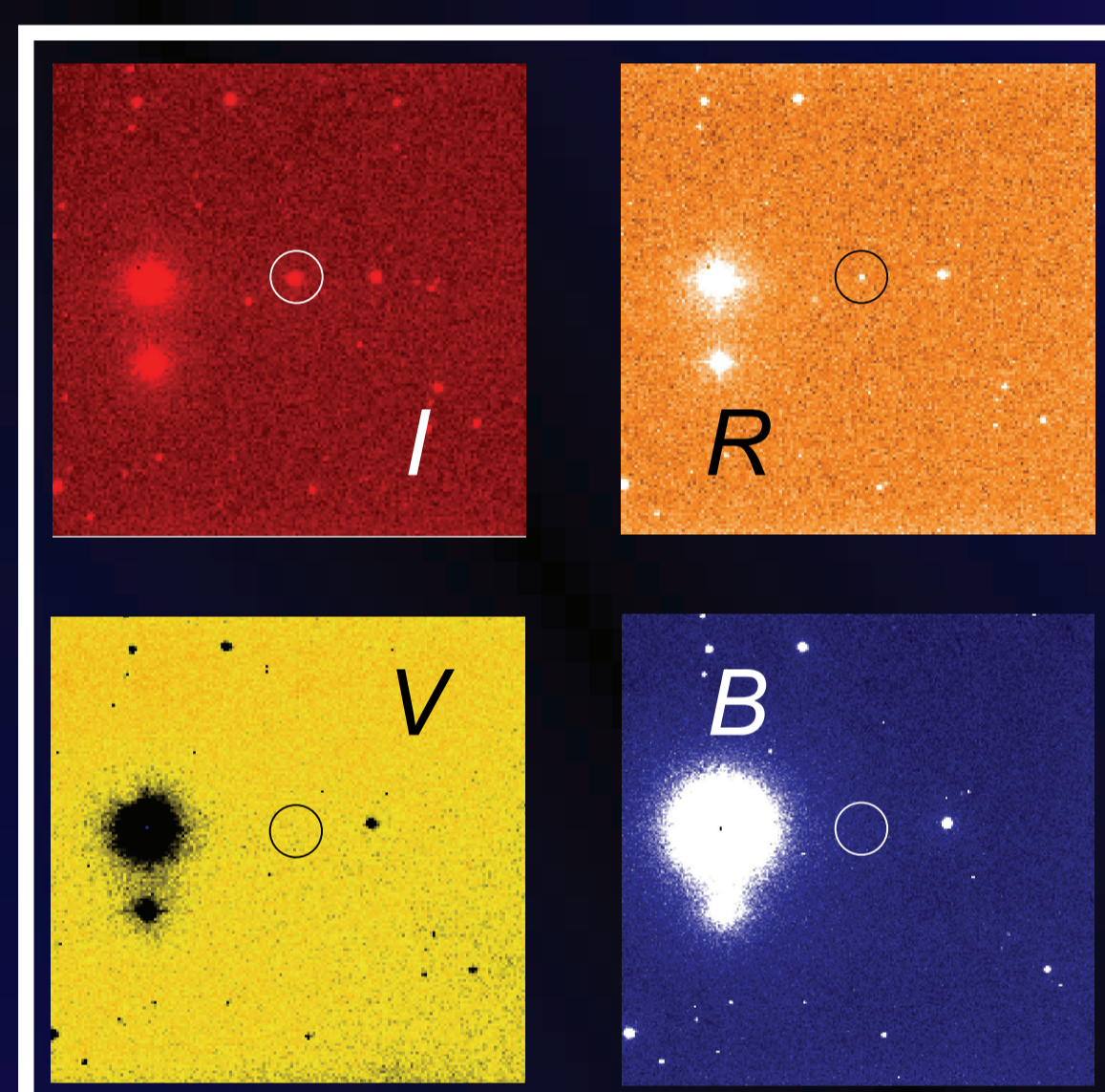
In addition to the many visual DIBs found, two DIB detections were reported in the near-infrared by Joblin et al. (1990), near 11797.5 and 13175 Å. These remain the longest-wavelength DIBs observed, and consequently have further implications for the nature of the carriers. Despite this, there have been few follow-up observations of these DIBs. We present here high-resolution UKIRT echelle spectroscopy of the two NIR DIBs. Detections towards sightlines exhibiting a range of visual extinctions are presented, and variations in the properties and profile shapes of the bands are considered in the context of the known properties of the narrow optical DIBs.

## Observations

UKIRT / CGS4 echelle observations at 11797.5 & 13175 Å - August 9<sup>th</sup> - 21<sup>st</sup>, 2008. 1-pixel width slit (0.6") of 91.5" was used. 2 × 2 sampling used with non-destructive readout. R ~ 37000.

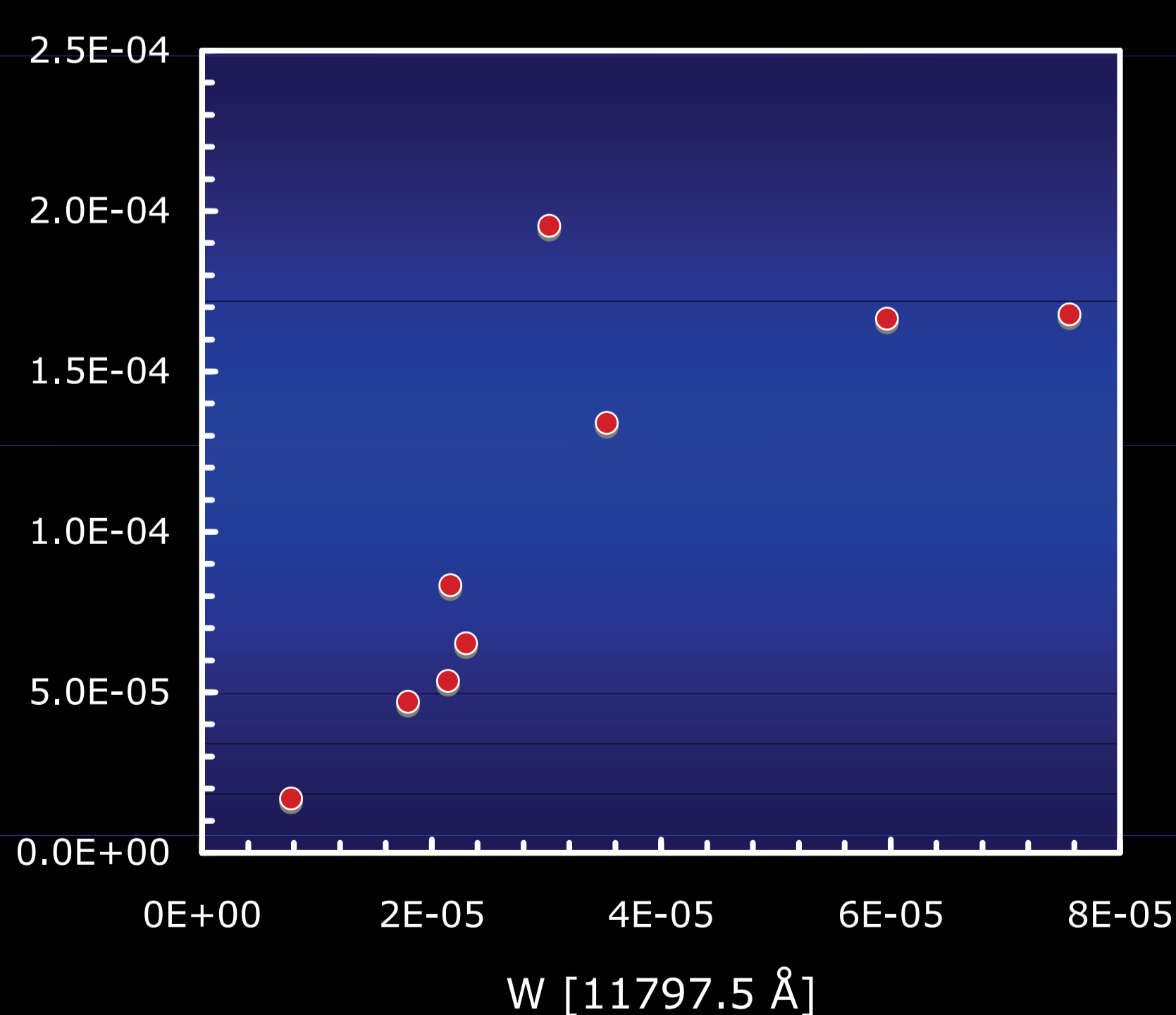
## Targets

- $\mu$  Sgr : "single cloud" sightline
- Monitoring of HD 204827
- Cyg OB2 No. 12: prototypical sightline
- Eight other heavily-reddened (above right) early-type stars (Stephenson, 1992) exhibiting very high  $A_V$  (6.6 - 15.8) due to diffuse ISM (Rawlings et al. 2000, Rawlings et al. 2003) and strong DIBs (right).

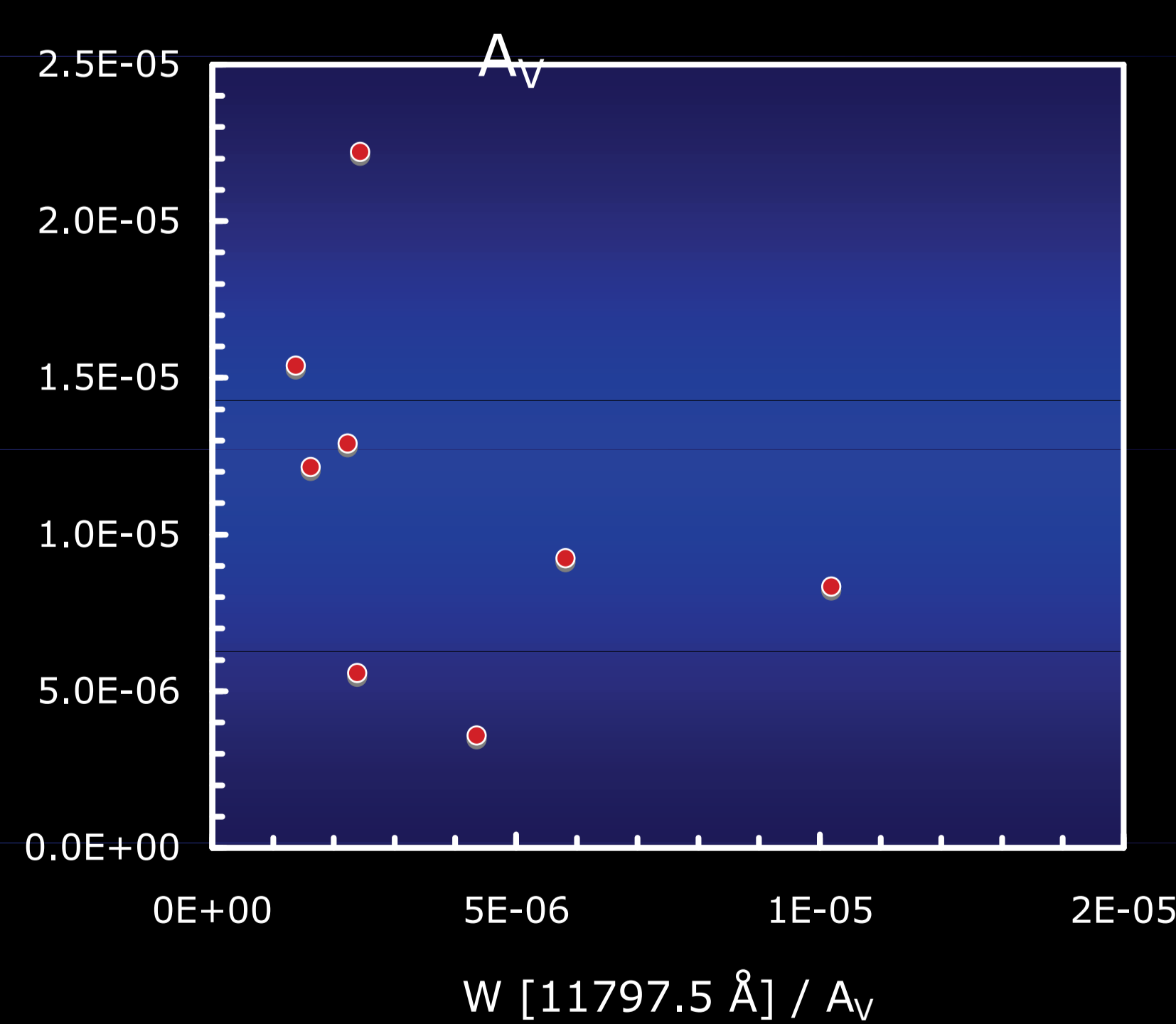


Examples of the UKIRT/CGS4 echelle NIR DIB spectra obtained. The  $\mu$  Sgr sightline was chosen as a "single cloud" sightline, and Cyg OB2 No. 12 is the prototypical bright early-type star with very high diffuse medium extinction.

## Equivalent widths



## Equivalent widths / $A_V$



Equivalent widths of the NIR DIBs. The plot on the right indicates the absence of a strong correlation on a per-unit-extinction basis.

## Initial Results & Conclusions

- The NIR DIBs appear to be reasonably well fitted by a single Gaussian, with some evidence of a long-wavelength wing.
- Neither (narrow) band shows complex substructure, contrasting with some of the narrow optical DIBs (e.g. Sarre et al. 1995).
- Per unit extinction, there is no strong correlation between the 13175 Å and 11797 Å DIB strengths.

## Future Work

- Check for (anti-)correlations against other DIBs and organics (e.g. 3.4  $\mu$ m) in the same objects.
- Modelling of carriers.
- Analysis of HD 204827 monitoring data.

## References

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