

More Interstellar Emission Features at 3.3-3.6  $\mu\text{m}$ ! A.T. TOKUNAGA, T. NAGATA, K. SELLGREN, R.G. SMITH (Inst. for Astronomy, Univ. of Hawaii), T. ONAKA, Y. NAKADA (Dept. of Astronomy, Univ. of Tokyo), A. SAKATA, and S. WADA (Univ. of Electro-communications, Tokyo). We have obtained 3.20-3.55  $\mu\text{m}$  spectra of HD 44179, NGC 7027, BD +30 3639, and Elias 1 with a new cooled-grating array spectrometer (CGAS) at the NASA Infrared Telescope Facility. At a resolving power of 1500, these are the highest spectral resolution data obtained on the family of interstellar emission bands at 3.3-3.6  $\mu\text{m}$  that are presently thought to originate from very small hydrocarbon grains (Allamandola et al. 1985; Geballe et al. 1985).

The present data set consists of observations of NGC 7027 and BD+30 3639 obtained in July 1985 with a 7-detector array, and observations of HD 44179 and Elias 1 obtained in January 1986 with a 32-detector array. A 300 line/mm grating blazed at 3.0  $\mu\text{m}$  was used for these observations. The entrance aperture of the spectrometer was 3 arc-sec.

Our most complete data set was obtained on HD 44179; the other sources were observed only on the main emission feature at 3.29  $\mu\text{m}$ . Our spectrum of HD 44179 is shown in the figure below. In addition to the 3.29  $\mu\text{m}$  feature, broad emission features which must arise from particles are observed at 3.34, 3.40, 3.46, 3.51, and 3.52  $\mu\text{m}$ . Curiously, these features appear to be nearly equally spaced in wavelength. The 3.40, 3.46, and 3.51/3.52  $\mu\text{m}$  features appear to be present in the lower resolution spectrum of HD 44179 published by Geballe et al. (1985). These features and an additional one at 3.56  $\mu\text{m}$  were also recently seen in sources IRAS 21282+5050 and AFGL 437 by de Muizon et al. (1986).

Our data set shows:

1. Confirmation of a new set of emission features in HD 44179, IRAS 21282+5050, and AFGL 437.
2. Yet another emission feature at 3.34  $\mu\text{m}$  that may be a new member of the family of emission features in this spectral region.
3. The 3.515  $\mu\text{m}$  feature observed by de Muizon et al. (1986) is seen to be two emission features in HD 44179 at our higher resolution.
4. Possible unresolved emission features at 3.37 and 3.45  $\mu\text{m}$  were observed; these emission features requires confirmation.
5. A short-wavelength wing to the strong 3.29  $\mu\text{m}$  feature is seen clearly for the first time in HD 44179. There appears to be no corresponding wing to the long-wavelength side of the 3.29  $\mu\text{m}$  feature.
6. The central wavelength and width of the 3.29  $\mu\text{m}$  feature is identical in HD 44179, NGC 7027, and BD+30 3639. The central wavelength of Elias 1 is the same as the others, but its width is narrower.
7. There appears to be structure in the 3.29  $\mu\text{m}$  feature of NGC 7027 and BD+30 3639 which is different from each other and HD 44179. This may indicate additional emission features, similar in intensity to the 3.46  $\mu\text{m}$  feature, superimposed onto the 3.29  $\mu\text{m}$  feature.

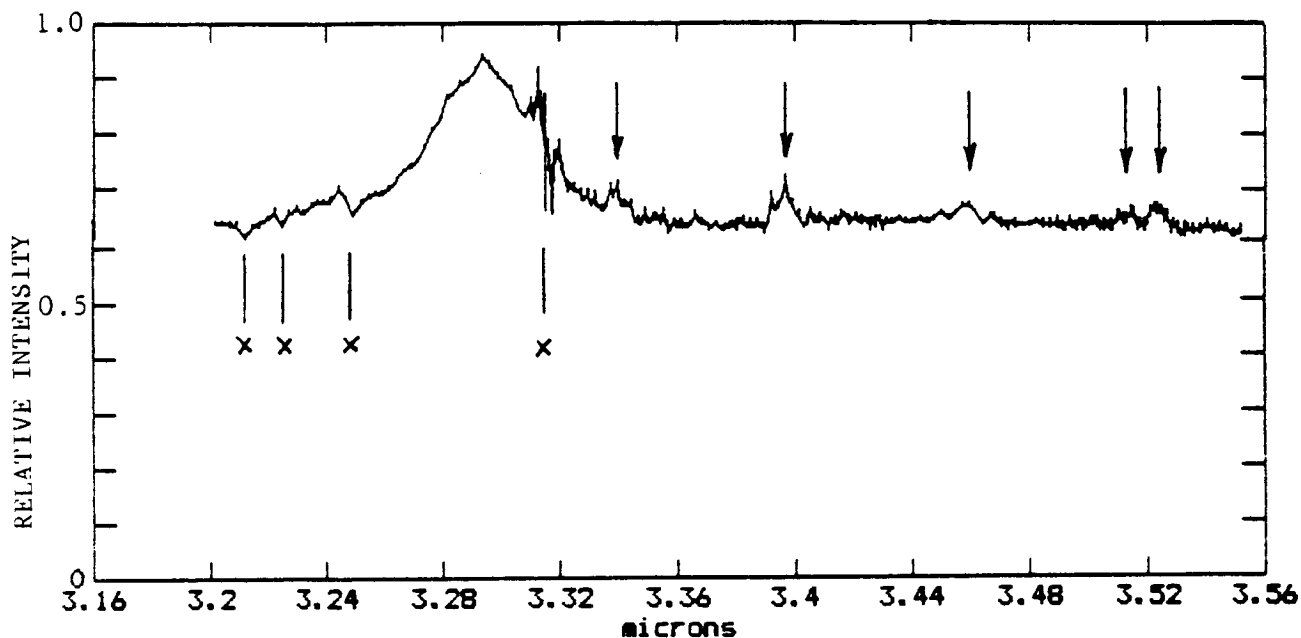
**Conclusions.** High resolution spectra of the 3.20-3.55  $\mu\text{m}$  region show new emission features and details of the emission feature profiles. While our spectra

show greater complexity than might have been expected, these spectra also offer a stringent test of any proposed identification. It is significant that the 3.29  $\mu\text{m}$  feature has an invariant central wavelength, even at high resolution, and this strongly supports the case for a very specific substance or mixture of substances which is giving rise to this feature. We do not have at present an identification for the other emission features.

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Spectrum of HD 44179. Emission features at 3.34, 3.40, 3.51, and 3.52  $\mu\text{m}$  are indicated by " ". Regions of poor telluric correction are indicated by "x".