The classification of several stars with digital low-resolution spectroscopy, combined with optical photometric measurements has allowed for a new picture of the high latitude galaxy, where the extinction may be determined in three dimensions. This extinction information, when combined with line profiles from high-resolution spectroscopy provides several new constraints upon the composition and chemical reactions present in the clouds. Evidence is presented for the possible shock-induced molecule formation in some of the clouds studied, and the composition of these clouds is compared with galactic plane molecular clouds.

References:
Desert, F.X., Bazell, D., and Boulanger, F. 1988, *Ap. J.*, 223,815.
Magnani, L., Blitz, L., and Mundy, L., *Ap. J.*, 295,402.
Penprase, B.E., Blades, J.C., Danks, A.C., Crane, P., 1990, *Ap. J.*, 365, *in press.*

32.19

Observations of the Interstellar C-H Band Near 3.4 μm

Y. Pendleton, S. Sandford, L. Allamandola, A. Tielens (NASA/Ames), K. Sellgren (OSU), and M. Tapia (UNAM)

To better constrain and quantify the composition of material in the diffuse interstellar medium (ISM), absorption spectra between 3600 and 2700 $cm^{-1}$ (2.8 and 3.7 μm) have been taken of objects which have various amounts of visual extinction along different lines-of-sight in the galaxy. The spectra of these objects contain a broad feature centered at ~3300 $cm^{-1}$ (~3.0 μm), attributed to O-H stretching vibrations, and/or a broad feature near 2950 $cm^{-1}$ (3.34 μm) attributed to C-H stretching vibrations. The lack of correlation between the strengths of these two bands indicates that they do not arise from the same molecular carrier. The features in the 3100-2700 $cm^{-1}$ (3.2-3.7 μm) region fall into one of two classes. We attribute the first class of features to material in the diffuse ISM on the basis of the similarity between the band profiles along the very different lines-of-sight to Galactic Center source IRS7 and VI Cygni #12. Similar features are also reported for Galactic Center source IRS3, Ve 2-45 and AFGL 2179. The interstellar feature for Galactic Center source IRS7 has sub-peaks at 2955, 2925, and 2870 (±5 $cm^{-1}$), which we attribute to C-H stretching vibrations in the $-CH_2-$ and $-CH_3$ groups of aliphatic hydrocarbons. The relative strengths and profiles of the 2955 and 2925 $cm^{-1}$ features towards five objects suggests an average diffuse ISM line-of-sight $CH_2$-/-$CH_3$ ratio of about 2.5, indicating the presence of relatively complex organic materials. The strengths of the subpeaks at 2925 and 2955 $cm^{-1}$, due to $-CH_2-$ and $-CH_3$ groups, respectively, correlate with visual extinction, strongly suggesting that the C-H stretching band is a general feature of the material along different lines-of-sight in the diffuse ISM. We find average ratios of $A_V/\tau_{(2925\ cm\text{-}1)} = 240 \pm 40$ and $A_V/\tau_{(2925\ cm\text{-}1)} = 310 \pm 90$ for the objects we have observed. We deduce that 2.6-35% of the cosmic carbon in the ISM is tied up in the carrier of this band, with the most likely value falling near 10%. Comparisons to laboratory spectroscopy are presented.

32.20

Near-infrared Ice Band Observations of Stars in the Corona Australis Cloud

W. P. Chen and J. A. Graham (CIW-DTM)

We have obtained medium-resolution spectra from 2.8 to 3.8 μm of several young stars in the CrA dark cloud using the infrared spectrometer at the CTIO. The 3.07 μm water-ice absorption feature is prominent among embedded objects, HH100 IRS, TS 13.1, and TS 2.4. Among the association members which have visible counterparts, the ice feature shows moderate strength for VV CrA, is marginally detected for R CrA, but is absent for T and TY CrA. Strong *extended* emission, probably arising from PAH molecules, is seen around 3.3 μm in the TY CrA reflection nebula. There is however no corresponding feature in the R CrA reflection nebula. Neither of the background stars (TS 3.5 and TS 4.1) seen along the line-of-sight through the cloud exhibits a detectable ice feature. A distinct 2.97 μm absorption, perhaps due to ammonia ice, has also been detected in some objects. Our observations indicate that condensation of ices onto grain cores has occurred in this cloud, possibly accounting for the existence of anomalously large grain sizes suggested by optical and IR photometry (Knacke *et al.* 1979, Ap.J.**179**, 847; Vrba and Rydgren 1984, Ap.J.**283**, 123) and polarization studies (Vrba, Coyne, and Tapia 1981, Ap.J.**243**, 489).

We have also observed two other young stars that are associated with Herbig-Haro objects, one with HH 52, 53, 54 and the other with HH 57. Each shows weak water-ice absorption and a relatively prominent 2.97 μm feature. The HH 52, 53, 54 star (IRAS12496–7650) has recently been identified as a highly variable Herbig Ae star. The HH 57 star (IRAS16289–4449) is an FU Ori star which flared up about 10 years ago.

32.21

**Models of Highly Extended Dust Shells around the Supergiants R Coronae Borealis and W Hydrae**

K. N. Nagendra and C. M. Leung (Rensselaer)

IRAS observations of R Coronae Borealis (R Cr B) and W Hydrae reveal the presence of extended cool dust shells around the central stars. Previous studies of R Cr B by Gillett et al. (1986, ApJ. 310, 842) indicate the possibility of a fossil shell (with a radius of 4.3 pc) resulting from an earlier mass loss episode. The carbon rich cool dust ($T \approx 30$ K) in this shell has been found to be nearly isothermal, as indicated by a uniform 60 μm/100 μm intensity ratio across the dust shell. We have constructed detailed radiation transport models to interpret the IRAS observations (which consist of fluxes at 12, 25, 60, and 100 μm as well as surface brightness at 60 and 100 μm) of R Cr B. In our model, the central star is surrounded by a compact (≈ 0.05 pc), hot ($T \approx 1000 - 200$ K) inner dust shell and a cold ($T \approx 50 - 20$ K) extended remnant dust shell. To produce the uniform dust temperature in the extended shell, we find that, in addition to radiation from the central star, heating by an external radiation field with a strength several times that of the local interstellar radiation field is required, provided the dust density distribution is not too steep (e.g., a power–law form with an exponent $\gamma < 2$).

W Hydrae is an oxygen rich red gaint with a 1 pc thick dust shell. It has been modeled by Hawkins (1990, A&A 229, L5) using an optically thin approximation. He concluded that a $1/r$ density law reasonably fit the observed surface brightness. Unlike R Cr B, the dominant dust heating mechanism for W Hydrae appears to be radiation from the central star. This is indicated by the 60 μm/100 μm intensity ratio which suggests a non–isothermal temperature structure. We have examined the dust shell of W Hydrae using an approach similar to that used for R Cr B. We conclude that for both systems a double shell model gives a better fit to the IRAS observations.

This work has been partially supported by the US Air Force under Grant AFOSR–89–0104.

32.22

The Chemical Composition of M17

S. Torres-Peimbert, M. Peimbert (UNAM), M.T. Ruiz (U. de Chile)

Long slit spectrophotometry of the H II region M17 has been carried out with the 4-m telescope at CTIO. We have derived the following abundances $N(He)/N(H) = 0.110 \pm 0.004$, $\log N(O)/H(H) = -3.18$, and $\log N(N)/N(H) = -4.25$. M17 is an outstanding object because it has a high metallicity and a high degree of ionization. Of the well observed galactic and extragalactic H II regions M17 shows the highest $N(He^+)/N(H^+)$ ratio. The observed abundances combined with a pregalactic helium abundance, $Y_p$, of 0.23 yield a $\Delta Y/\Delta Z$ ratio of $3.6 \pm 0.6$.