group of emission bands with the best known members at 5.3, 6.2, 7.7, 8.6, and 11.3 μm. Bregman et al. (1983, Ap.J., 274, 666) observed two additional bands at 5.6 and 6.95 μm confused with a [Mg V] emission line. We have now observed both of these UIR features in a number of objects, none with high enough excitation to have a [Mg V] line. These bands are generally 10-15% as strong as the 5.7 μm band, and correlate with the other features. The significance of these additional features will be discussed.

14.12
IR Recombination Lines from L1536 and Other Low Luminosity Core or Broad Wing CO Sources
H.A. Smith, J. Fischer, P. R. Schwartz (NRL), and T. R. Geballe (UKIRT)
L1536 is a nearby dark cloud in which CO and NH, observations indicate a dense core, in the preliminary or early stages of star formation (Myers, P. C. and Benson, F. J., 1983 Ap.J., 266, 309). Other analogous dense cores, e.g. L1551, show evidence for stellar activity and bipolar molecular outflow (op. cit.).

We observed the two micron source in L1536 (Benson, Myers, and Wright 1984, Ap.J., 279, L27) with the FTS at the KPNO 4m telescope, and found that it emits Brackett γ radiation with a flux $2 \times 10^{-10} \text{ W/m}^2$. We also observed L1620, L1688, and L1582 and see limits to the Brγ flux from these. We then used the UKIRT telescope and grating spectrometer to measure the Brackett γ flux from the source in L1536. We find it is 5 x $10^{-11} \text{ W/m}^2$, which is 3-10 times below the expected value, depending on the model assumed. We have set comparable limits to the Brγ flux from L1655, L1551, and MGC 2071. In a series of VLA observations at 6 cm we measured or set limits to the continuum from a selection of these objects. We present a discussion of these results, and draw comparisons with the properties of higher luminosity sources. We will also report on measurements of the Pβ and Brγ lines from T Tauri.

Session 15: Dust and Cool Stars
10:00–12:00 (Informal Lounge)

15.01
Chromospheric Dust Formation and Mass Loss
R.E. Stencel (NASA HQ & JILA)
Mass loss from red giant stars has posed a key problem since Deutsch (1956) announced the existence of strong blue-shifted circumstellar gas in the spectrum of Alpha Herculis and like stars, implying matter flux of up to one solar mass per million years from these objects. With the recognition (Hartmann 1980; Stencel et al. 1981; Carpenter et al. 1985) that red giant chromospheres are geometrically thick – several stellar radii in extent – it is plausible that the ‘condensation instability’ of plasma physics (Field et al. 1969; Lepp et al. 1985) could create a fractal extended chromosphere in inhomogeneous regions of warm and cold (500K) matter. Gas at 10,000K subjected to density enhancement (turbulence) experiences radiative losses that act to cool and reduce the gravitational force acting on it. The observed quenching of chromospheric emission lines may be a product of gas/dust ratio. In this scenario, molecular cooling is related to the instability onset. Spectral imaging of the 10 micron silicate feature within the first ten stellar radii (1–3 year flow time) of red giants should show profile changes due to dust formation and processing in the outflow. Several questions remain to be addressed: how is the dust acceleration coupled to the gas, especially in low dust-gas ratio (‘oxygen rich’) stars? Is the energy balance preserved between chromospheric photons and material motion? The scenario is sufficiently appealing that further study is warranted. Most references are to Ap.J.

15.02
The Infra-red Colors of Cool Model-Star Stellar Atmospheres
R.A. Bell (U. Maryland)
Infra-red synthetic spectra have been computed for the grid of model atmospheres for cool stars published earlier (Gustafsson et al. Astr. Ap. 42, 407, 1975; Bell et al. Astr. Ap. Suppl. 23, 37, 1976). The transmission profiles of the filters employed in various color systems have been used to calculate synthetic infra-red colors. The color systems considered are those of Johnson, of Glass and of the Caltech-CTIO group. The narrow band measurements of Cohen, Frogel, Persson and their collaborators have also been considered. These synthetic colors have been compared with observations and temperatures have been deduced. This work has been carried out in collaboration with B. Gustafsson. It is supported by NSF under grant AST80-15957.

15.03
IRAS Observations of Anomalous IR Emission in G-Type Stars
S.F. Ostenwal (NRL/SFA)
In the IRAS Point Source Catalogue there are 225 sources adjacent to single, bright G-type stars. Assuming that the IRAS sources are the infrared counterparts of these stars, the 12 and 25 μm measurements indicate emission 100–1000 times greater than that expected for ordinary G-type stars. Since there are > 9500 G-stars brighter than the magnitude limit of the IRAS-detected stars, at least 2% of all G-type stars appear to have substantial IR emission beyond 12 μm. The derived color temperatures for this excess emission are typically in the range from 700 to 2000 K. However, in seven cases, IRAS measurements at 60 and 100 μm suggest that a cooler component with T < 100-500 K may also be present. The physical characteristics of this excess emission, along with plausible models for its origin, will be described.

15.04
Three Dimensional Mapping of The Atmosphere Of An Active K-Dwarf Star
E.F. Guinan and S.W. Wacker (Villanova Univ.), S.L. Baliunas and J.G. Loser (CFA)
The eclipsing binary V471 Tau (K2V + wD) offers an unique opportunity to study the vertical structure of an active K-dwarf by using the white dwarf companion as a beaming probe of its atmosphere. In V471 Tau the atmospheric spectrum of the cool star is seen in absorption against the nearly featureless continuum of the DA white dwarf as it moves behind the K2 dwarf preceding and following the total occultation eclipse which lasts about 50 minutes. Observations made with the IUE satellite from 1978 through 1985 reveal the presence of chromospheric and transition region absorptions superposed against the nearly featureless white dwarf spectrum. These features have been detected as far as one stellar radius above the K-star's surface, and at one time they were not detected at all, even though the white dwarf was close to the limb of the cool star. Photometry of the star reveals the presence of starspots regions on the K star, which vary with time over the surface of the K star. All simultaneous analysis of the photometry and the IUE data was undertaken to determine the location of the active regions on the star's surface at the times when the IUE observations were made. Correlations were found between the strength of the UV features and the location of the starspot regions which indicate the features are produced above the active regions possibly from loop structures. We gratefully acknowledge support from NASA Grant No. 5-382.