ABSTRACTS

36.07 The KL Cavity, C. G. Wynn-Williams, E. E. Becklin, D. Maloney, R. Genzel, B. C. Berkeley, D. Downes, J. I. M. Orenie. Using the IRTF on Mauna Kea we have mapped the central ~ 20" of the Orion KL region with 2" resolution at six wavelengths between 2.2 and 30 μm. We find a) that the 20-30 μm color temperature shows little variation over the face of the region, b) that the 8-12.5 μm color temperature has prominent peaks only at the infrared sources BN and IRC2 and c) that the regions of strong scattering at 2.2 and 3.8 μm coincide with regions of strongest 20 and 30 μm thermal emission. In a separate experiment we find that the color temperature and stellate optical depth of IRC4 do not change with diaphragm size in the way expected for a centrally-heated molecular cloud fragment. From these observations and a variety of other radio and infrared data we conclude that the geometry of the KL nebula is that of a cavity approximately 30" (2 x 10^17 cm) in diameter rather than that of a number of isolated objects. The cavity is centered on IRC2, which we estimate to be sufficiently powerful (10^5 L_ν) to be the source of essentially all the luminosity from the KL nebula, except for ~ 10^3 L_ν arising from the BN object. In this model the other infrared peaks in the KL nebula (IRC3, IRC4, etc.) are manifestations of irregularities in the distribution of material surrounding the cavity rather than individual self-luminous infrared sources.

36.08 Observations of Ethyl Cyanide on Orion, F. YUSEF-ZADEH and M. NEHRIS, Columbia Univ. J. BALLY, Bell Telephone Laboratory. Using the 7-m NTL radiotelescope, we have detected a total of at least 35 new rotational transitions of ethyl cyanide (CH_3CHCN) toward the Kleinmann-Low Nebula (KL) in Orion. The observations were made between 90 and 145 GHz and include transitions arising in levels from J=7 to J=16. The data for all lines are consistent with a constant V_LSR (4.5 km s^-1) and a constant line width (13 km s^-1). Ethyl cyanide emission in this direction is therefore unique in that it arises only from the 'hot core' component of KL. The many line intensities can be used to determine the mean temperature of the hot component. By fitting gaussian profiles to all observed lines, we find a relatively large value for the excitation temperature (275 K). This is somewhat higher than indicated by other molecules, implying that CH_3CHCN might have a large gas phase abundance only in a hot, compact nucleus which does not dominate all the emission from any other molecule.

36.09 Analytic derivation of Paczynski's empirical core-mass luminosity relationship, J. PAULKNER, UC, P. P. EGGLETON, JDA, R. L. GILLILAND, HAC, F. HOYLE, CAMBRIA. The luminosity of a giant star may be found by solving one analytic equation self-consistently. The equation incorporates thin-shell nuclear burning, a simple relation-ship between shell temperature and core properties, an analytic radius-mass relation for cold degenerate cores, and an approximation to their hot, non-degenerate extensions.. Both first giant-branch and double-shell-source luminosities are well represented. A close fit is obtained to Paczynski's computer-derived empirical core-mass luminosity relationship, as illustrated below:

36.10 Convective Heating of the Inner Core in the Core Helium Flash, P. W. COLE and P. DEMARQUE, Yale U. Obs., and R. G. DEUPREE, LANL - Cole and Deupree (Ap. J., 239, 284; Ap. J. to be published) have investigated the intricate time dependent interaction of convection and the thermonuclear runaway with a two-dimensional finite difference code. These calculations show that convective overshooting occurred across the highly stable temperature inversion of the initial model which was taken from a traditional stellar evolutionary sequence. A smoother temperature profile was produced from this heating of the inner core by a series of convective cycles resulting from the interaction of convection and the thermonuclear runaway. We have found that the heating of the inner core produced by this overshooting always occurs on a time scale significantly shorter than the evolutionary time scale even at the peak of the flash. We have modeled these convective cycles with a suitably modified stellar evolution code. The consequences of this convective interior heating are investigated over the approximately 1150 years from the onset of the formal convection zone to the peak energy model of the core helium flash (used as the initial model for the hydrodynamic calculations). The simulation of the large convective eddies which transport energy across the normally stable temperature inversion produces the desired result: a smoother temperature profile. However, the physical structure (most importantly the thermal structure) is not inconsistent with the models produced by the hydrodynamic calculations prior to the peak of the flash. Hence, the initial models used for the original Cole and Deupree hydrodynamic calculations are considered acceptable within the uncertainties of our simulation. Reasonable variations of the model parameters will also be discussed. This research has been supported in part by NSF grant AST-80-23745.