INFRARED STARS AND THE MORPHOLOGY OF DUSTY REGIONS*

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The properties of infrared stars are discussed. Many objects are known which radiate in the infrared as cool blackbodies. These have been called NML Cygnids because of their resemblance to NML Cygni. Most of these are variables and change their effective temperature and brightness in such a way that their effective angular diameter remains constant. An example is +10216 which changes its temperature from $410^\circ K$ to $510^\circ K$ but maintains an angular diameter of 1 arc second. These objects appear to be dust shells enshrouding embedded normal stars. The dust shell absorbs most of the stellar radiation and reradiates it in the infrared. The shell acts as a calorimeter of the star and monitors its changing bolometric luminosity.

A class of objects in which a strong infrared source is accompanied by diffuse symmetrical polarized visual objects has been identified. The most extreme case is IV Zwicky 67 (the egg nebula). Other objects which are morphologically similar are η Carinae, VY Canis Majoris, M1-92, HD 44179, and the Air Force Cambridge object CRL 618. These all appear to be luminous stars surrounded by an optically thick dust region which is probably in the shape of a disk or a torus (doughnut). This inner dusty region accounts for most of the observed luminosity. The light that escapes through the holes in the doughnut illuminates an outer optically thin medium. Because of the geometry this scattered light can be highly polarized. The geometry may be characteristic of protostar collapse but a late evolutionary stage involving dust ejection by the central star cannot be ruled out. In any event the doughnut configuration seems suited for the formation of other planetary objects in orbit around the central star and the outer optically thin regions bear a geometrical resemblance to the Oort cloud of comets in the solar system.


MARKARIAN 376 — A SEYFERT GALAXY WITH STRONG Fe ii EMISSION

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In a spectrophotometric survey of Seyfert galaxies, Markarian 376 was found to have strong, broad Fe ii emission features of the type previously identified in two quasars and a few other Seyfert galaxies. The relative intensities of the individual emission lines and features in the spectrum of Markarian 376 were measured. The strongest Fe ii feature, $\lambda 4570$ containing the multiplets (37) and (38), has a relative strength nearly 0.6 that of Hβ. The relative strengths of the Balmer lines do not agree with recombination theory; there is probably a contribution to the excitation from collisional excitation and perhaps self absorption. The profiles of the H i and He i lines are essentially identical with full widths at half maximum of approximately 5000 km s$^{-1}$. Weak narrow forbidden lines are also present, with widths of approximately 400 km s$^{-1}$. A reasonable extrapolation of the observed continuous spectrum has more than enough near-ultraviolet photons in the region $\lambda 2300-\lambda 2800$ to produce all the observed Fe ii emission by resonance fluorescence. Practically all the Seyfert 1 galaxies observed to date in this survey have Fe ii emission in their spectra.

OBSERVATIONS OF FAINT Hii REGIONS IN OUR GALAXY

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