son of spectra in the core region and main body of early-type galaxies allows study of core dynamics and stellar populations.

Long-slit spectra were obtained at CFHT with the Herzberg spectrograph of 10 galaxies. Two slit widths were used, 2 arcsec and 0.75 arcsec. The rotation curves and the velocity dispersion profiles for each galaxy were found using the fourier quotient method. No unusual rotation curves were found (counter and co-rotating cores or steep inner rotation curves in those cases where the outer part of the galaxy is too faint) out of the 5 galaxies in which the data is of reasonable quality. The velocity dispersion profiles also did not show any peculiarities.

Our data is compared with that used by Kormendy and Illingworth (1983, ApJ, **265**, 632) to obtain their L–σ relation (Figure 11). Our data are represented by a filled circles with the Arp number next to the data point and Kormendy and Illingworth's data are represent by x's. NGC 1889 (Arp 123) has an unusually low velocity dispersion for the assumed B-band absolute magnitude, but it should be noted that this is one of the galaxies whose magnitude is uncertain. All of the other galaxies do not appear to be unusual.

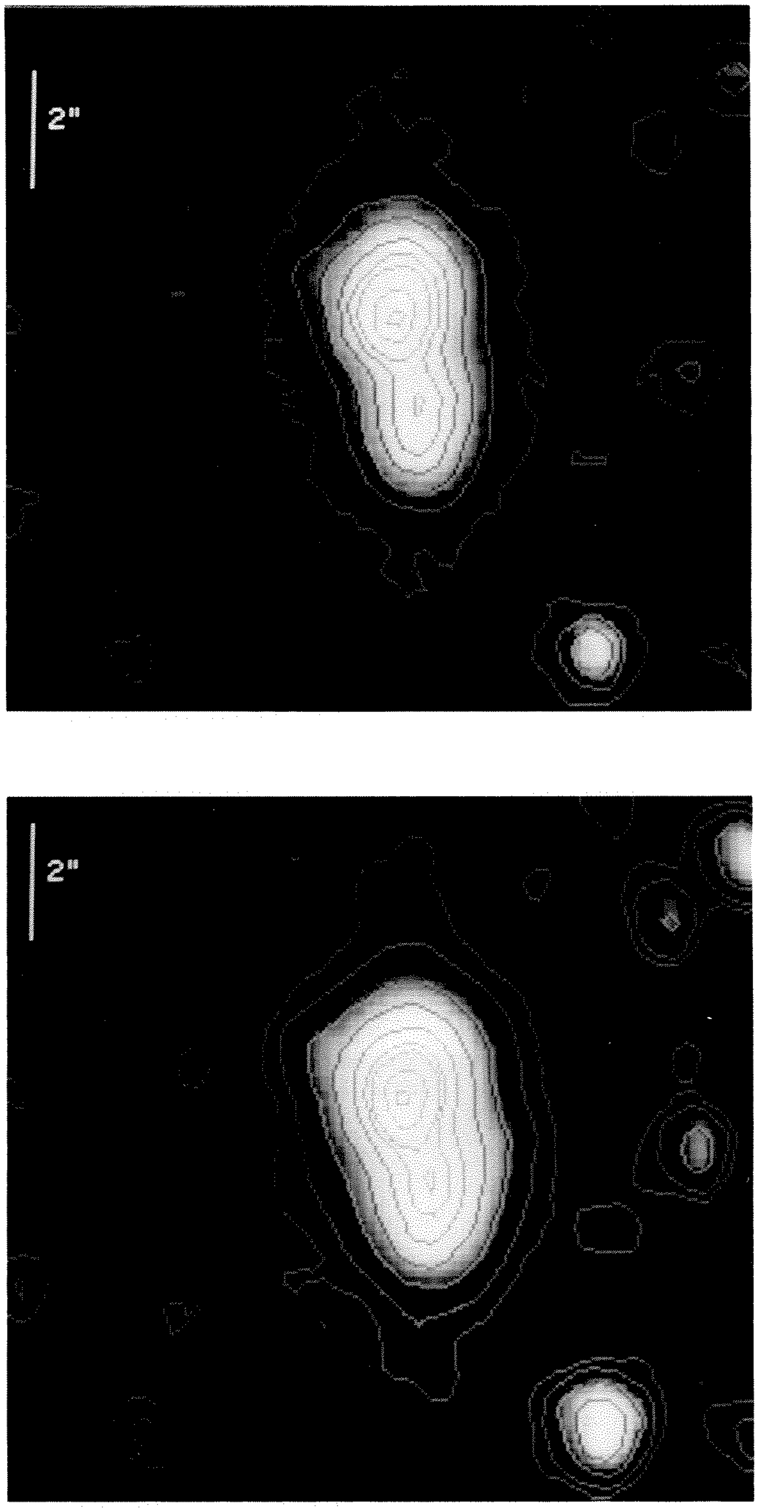
We found no evidence for unusual rotation curves or velocity dispersion profiles in our sample of elliptical galaxies. The galaxies that we observed do not show any dynamical evidence of a merger. Zepf et al. (1991, ApJ, **383**, 524) find that the colors of elliptical galaxies in compact groups are consistent with those in the field with only a few exceptions. One would expect that the merger rate in compact groups would be much higher than for field galaxies and therefore result in anomalous colors. Ellis (1992, preprint) argues that the small dispersion in the color-velocity dispersion relation indicates that elliptical galaxies are old. Rose (1985, AJ, **90**, 1927) and Bower et al. (1990, Astr. J., **99**, 530) also find that ellipticals in clusters are older than field ellipticals (6-7 Gyr older). Our observations are extremely sensitive to changes in the core whereas the above authors tend to measure the global properties of the galaxies. These results suggest that mergers that make elliptical galaxies in clusters and groups could have taken place around a redshift of 2 or 3 and are uncommon now.

T.L. Kroeker, U. of Toronto
R.G. Carlberg, U. of Toronto
C. Pritchet, U. Victoria

Optical Imaging of Proto-Planetary Nebulae

Through observations in the infrared and radio, particularly OH and CO lines, it has been determined that most asymptotic giant branch (AGB) stars possess slowly expanding, spherically symmetric circumstellar envelopes (J. Herman and H.J. Habing in The Late Stages of Stellar Evolution, S. Kwok and S. Pottasch eds. 55-71, 1987). However, through observations in the optical and radio, it is found that only a small fraction of the planetary nebulae, into which these AGB stars evolve, possess a spherical morphology. This raises the questions of when the transition in morphology takes place, and what is its mechanism? A clue is found from observations in the UV which show that many hot PN central stars possess a tenuous high velocity wind (~2000 km/s). It has been suggested

Figures 12a and 12 b



Figures 13a and 13b

that asymmetries in the remnant AGB envelope become amplified by the shocks that are formed by the fast wind (B. Balick, Astron.J. **94** (3), 671, 1987). Specifically, the asymmetry must be an enhancement in density along the equatorial plane relative to the polar regions. These models show that this density ratio, or density contrast, must be large in some cases particularly in the formation of exotic butterfly PN such as M2-9 and NGC2440.

We have begun to investigate these questions as part of our study of proto-planetary nebulae (PPN) – stars in transition from the AGB to PN phase. By searching the IRAS database, we have been able to select a number of PPN candidates based upon the infrared emission from their circumstellar shells. Optical counterparts have been identified by ground-based mid-infrared photometry at CFHT, UKIRT, and IRTF between 1985 and 1991. By combining the IRAS and mid-infrared photometry with optical and near-infrared photometry, the flux distributions of these candidates were determined. In most cases they show the double-humped distribution expected for a PPN, with flux detected in the visible and near-infrared from the reddened photosphere and in the infrared from a cool circumstellar dust shell.

Indirect evidence for the existence of PPN with asymmetric circumstellar shells has been presented by Hrivnak and Kwok (Ap.J. **368**, 564, 1991). They noticed a few PPN with very similar mid-and far-IR flux distributions which had very different distributions in the optical and near IR. This can be understood if the PPN have circumstellar envelopes with large density contrasts, where a 'thick disk' of material would prevent shorter wavelength radiation from escaping in certain directions while maintaining an isotropic emission of longer wavelength radiation.

To seek more direct information on the size and shape of their circum-stellar shells, as well as to detect faint (V>20) optical counterparts, ~25 PPN were observed with HRCam in June 1991. If a PPN with a thick disk is viewed edge on, it should show a bipolar morphology. This appearance is due to the light which escapes perpendicular to the disk (along the poles) being scattered by the dust into the direction of the observer. The result is two bright lobes separated by a faint region. This is a model commonly used to explain bipolar appearances. It was first suggested by Edward Ney to explain the optical morphology of AFGL 2688 (Sky and Telescope, Jan. 1975). This object, also called the 'Egg Nebula', is now known to be a PPN. Another well known bipolar nebula whose optical morphology is explained by this picture is IRAS 09371+1212, also called the 'Frosty Leo' nebula (Dougados et al. A&A,**227**,437,1990).

Figure 12 shows Mould V and I-band images of the PPN IRAS 17150-3224 taken with HRCam in the fast guiding mode. North is at the top, east is to the left, and the scale is indicated. Figure 13 shows similar images for the PPN IRAS 17441-2411. The resolution is 0.72" and 0.81" for 17150-3224 and 0.68" and 0.62" for 17441-2411 in the V and I filters respectively. In figure 14 we show the flux distribution of 17150-3224 including the V and I magnitudes determined from the HRCam images. The near IR photometry we obtained at UKIRT and the IRAS data are also shown in Figure 14. The V-band image of 17150-3224 shows two distinct brightness peaks separated by ~2.98". The I-band image shows the brightness peaks starting to merge together to form one extended region of

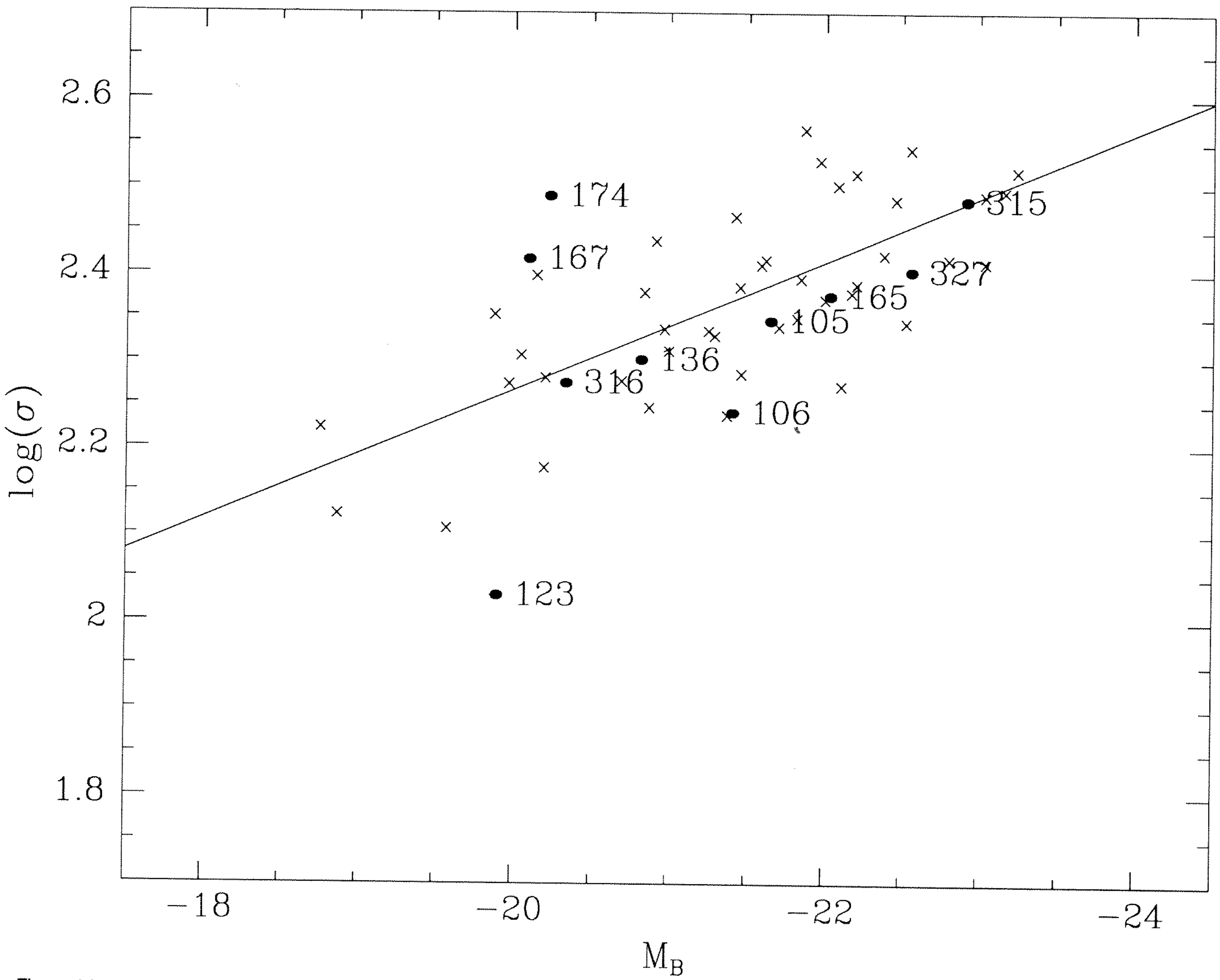


Figure 14

emission. Our two-dimensional radiative transfer models show that this morphological trend with wavelength is to be expected if a thick disk is present and scattered light is being observed. The V and I-band images of 17441-2411 clearly show two brightness peaks separated by ~1.56". We are presently comparing the images and flux distributions of these two sources with a thick disk model to determine the properties of their circumstellar shells. These HRCam images have allowed us to see interesting morphological details which will place important constraints on the models.

Of the ~25 PPN candidates observed with HRCam, a few seem to be extended with essentially a spherical symmetry. For example, the circumstellar dust shell of the very young PN IRAS 21282+5050 was resolved in the optical for the first time (Kwok, Hrivnak, and Langill 1993, in press). It is possible that some of the PPN in our sample have a bipolar morphology, but have an orientation which is not favorable to its detection or are simply not resolved at a resolution of 0.7". However, there are now three known bipolar PPN which possess a thick disk. This is a clear indication that high density contrast mass loss can indeed occur in the AGB phase.

P. Langhill

Imagerie Infrarouge au TCFH avec Monica

MONICA, la caméra pour le proche infrarouge construite à l'Université de Montréal, est utilisée régulièrement au TCFH depuis septembre 1991. Malgré des conditions météorologiques souvent moins propices que la normale, des résultats spectaculaires ont été obtenus, dont la détection de la structure de l'émission H_2 dans la région de formation d'étoiles Céphée A Est, l'imagerie du mirage gravitationnel 2237+0305 dans la raie $H\alpha$, et l'imagerie des galaxies en intéraction IC 1623. Une des principales caractéristiques de MONICA est l'utilisation de filtres circulaires variables (CVF) qui permet de détecter les raies d'émission même en présence d'un continu important. En ce sens elle complimente les caméras TCFH (Redeye) qui sont optimisées pour l'imagerie dans le continu.

MONICA contient un détecteur HgCdTe de 256x256 pixels, ce qui lui donne un champ de 57" pour une échelle de 0.225" par pixel au foyer Cassegrain f/8 du TCFH. Outre les filtres variables qui couvrent un domaine de longueur d'onde de 1.45 μm à 2.5 μm avec une résolution spectrale R=70, les filtres standards J,