40.07
Dynamical Evolution of Planetary Nebulae
S. Krock, K.M. Volk (Univ. of Calgary)

The dynamical evolution of planetary nebulae is considered under the Interacting Stellar Winds model. Analytical solutions to the dynamical equations are obtained assuming energy-conserving interactions. We have also investigated the effects of radiative cooling and the possible variation of the stellar wind from the central star. More realistic numerical calculations are performed taking into account the evolution of the central star using the model results of Schönherr (1983, ApJ, 272, 708). The time dependence of the mass loss rate and the velocity of the central-star wind is also included. The evolution of the ionization sphere is obtained together with predictions of the evolution of x-ray and radio emissions from the nebula.

40.08
IRAS 0429+5360P3: A Remarkable Galactic Infrared Source

As part of a program to study preliminary IRAS sources we have found a peculiar galactic source IRAS 0429+5360P3 that appears related to a 17th mag nebula. We have obtained high resolution images and spectra at visible wavelengths, and 1 to 20 μm photometry and spatial studies at infrared wavelengths. The red and 1 μm images show that the object is double with a separation of 1.6′ at position angle ~320°. There is a faint optical nebula of 12′ diameter surrounding the two point sources. Optical spectroscopy shows that the brighter component has the absorption spectrum of an A star. The infrared properties of the source are similar to those of a galaxy or Galactic H II region/molecular cloud complex, with an energy distribution peaking at 100 μm, and a diameter on the order 10′. The nature and evolutionary state of this object are unknown although it bears some resemblance to a protoplanetary nebula.

40.09
An Ionization and Dust Model for the Planetary Nebula NGC 3918
J.P. Harrington (U. Maryland), R.E.S. Clegg, and D.J. Monk (U. College London)

An ionization model has been constructed for NGC 3918. To fit the extensive optical and UV line and continuum data, it was necessary to depart from spherical symmetry by including a low density region which is optically thin even for λ < 228 Å. Consequently, the central star can be represented by a non-LTE model atmosphere with an effective temperature of 140,000 K, which exceeds the He II Zanstra temperature.

Dust in the form of carbon grains with a power-law distribution of sizes is introduced into this model, and the equilibrium temperature and thermal IR emission of the grains are calculated for each grain size and radial zone. Heating by stellar and nebular continuum radiation and by scattered Lyα, C IV λ1549 and N V λ1240 line radiation is included. The line transfer problem is solved approximately.

The far infrared IRAS fluxes and the ground-based infrared observations are corrected for the nebular line emission and the number and sizes of the grains are adjusted to fit the corrected fluxes. A dust/gas ratio of 1.3-3 by mass is obtained. This implies a 50% internal absorption of the C IV λ1549 line. Such attenuation of the λ1549 line permits the model to fit both this line as well as the C III λ1227 and C III λ1908 recombination lines. The gas phase C/O abundance ratio for this object is 1.6.

Session 41: Normal Galaxies II
2:30-3:50 (Maricopa Room, Convention Center)

41.01
A VLA Study of M81
F. Bash (U-Texas), M. Kaufman (Ohio State)

VLA observations of the 1.6 cm and 20 cm continuum radiation from the galaxy M81 are described. With a resolution of ∼40′′, the continuum radiation in the arms is detected together with about 40 sources along the arms which coincide with the Hα sources observed by Hodge and Kennicutt.

The width and location of these radio continuum arms are compared with the blue light spiral arms and with the HI 21 cm arms as mapped by Hine and Rots.

41.02
The Chemical Composition Gradient in M81
D.R. Garnett, G.A. Shields (U-Texas)

We have observed 17 HII regions across the disk of the Sab spiral galaxy M81 with the goal of studying the chemical composition of early-type spirals. Spectra of each region were obtained with the 2.7-meter telescope and IDS spectrograph at McDonald Observatory; the spectra cover the wavelength range 3500 Å to 7000 Å with a resolution of approximately 7 Å. The HII region sample spans the range 2.8 - 15 kpc in galactocentric radius. We see a radial increase in the excitation across M81, with log ([OIII]/Hβ) increasing from ~0.8 in the innermost regions to ~0.8 in the outermost region at 15 kpc. The excitation across M81 resembles that seen in M01, even though M01 is a later Hubble type (Scd). This contrasts with past impressions that early-type galaxies have higher metallicities and lower excitation.

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41.03
Far-Infrared Spectroscopy of M82

We report detection and partial mapping of the 52 and 88 μm fine structure lines of [OIII], the 63 and 146 μm [OII] lines and the 158 μm [CII] line toward M82. The far-infrared emission lines are bright and carry about 0.5% of the bolometric luminosity in the central 60′. The far-IR line emission strongly peaks at the nucleus and has a diameter consistent with the radio and far-IR continuum source (~40′). Some [CII] emission may be associated with the high velocity filaments, and there appears to be a special velocity component (V_LSR ~ 150 km s⁻¹), possibly associated with the brightest compact radio source. The neutral gas is unusually warm (T ~ 200K) and dense (n_H ~ 3 x 10⁶ cm⁻³), indicating that a substantial fraction, (10 to 30%) of the interstellar gas in the nucleus of M82 comes from a UV excited, clumpy medium. The average electron density in the ionized gas is ~5, which is substantially larger in the vicinity of radio point sources. We discuss the implications for star formation at the nucleus of M82.

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