55.05 (Dissertation)
Properties of the Magellanic Type Galaxies
S.C. Dwelsh (U. Minnesota)

Studies of the photometric, kinematic and dynamical properties of the Magellanic type galaxies are undertaken in order to ascertain the systematic properties of the late stages of spiral structure in the bubble sequence. Statistical analyses of large optical and radio data sets, contained in the newly completed Third Reference Catalog of Bright Galaxies, as well as a general survey of the largest Magellanic type galaxies on the Palomar and UK Schmidt Photographic Surveys, are used to determine properties such as mean color, frequency of bar formation, intrinsic shape, and the abundance of physically associated neighbor galaxies. Detailed photometric studies of a few selected Magellanic galaxies are carried out using photographic and new-technology CCD area detectors. Studies of these same systems are conducted using the technique of Fabry-Perot interferometry in order to map the two-dimensional ionized gas velocity fields.

These galaxies are predominantly barred, with the center of the stellar bar often displaced from the photometric center of the galaxy disk. The dynamical consequences of such an asymmetric mass distribution are modeled using a simple prolate spheroid and exponential disk potential field and compared directly with observational data from the photometric and kinematic investigations. A systematic search is made for matter trapping and gas streaming motions caused by the bar and its associated stable Lagrangian points. Finally, a series of recent theoretical studies, as well as a set of original numerical calculations, are used to explore the origin and dynamical evolution of these intriguing galaxies.

55.06
Atomic Hydrogen in the Elliptical Galaxy NGC 4278
J. F. Lees (Princeton University Observatory)
J. H. van Gorkom (Columbia University)
G. K. Knapp (Princeton University Observatory)

The E1 galaxy, NGC 4278, has been mapped in the 21 cm line of atomic hydrogen using the VLA, with spatial and velocity resolutions of 60″ and 41 km s⁻¹ respectively. This galaxy, which is located in a small group about 16.4 Mpc distant (for H₀ = 50 km s⁻¹ Mpc⁻¹), was one of the first ellipticals to be detected in optical emission lines and HI. Previous observations (Raimond et al. 1981, Ap. J., 246, 708) have shown the atomic gas to be in a rotating ring, of diameter about 15 kpc, with a total HI mass of about 7 × 10⁵ M☉.

Our observations confirm the main results of these previous studies. However, with our higher resolution and sensitivity, we also detect emission from the central parts of the gas disk, as well as possible diffuse emission extending away from the galaxy to the west. The nearby S0 galaxy, NGC 4286, at a projected distance of 8.5, or 40 kpc, is also detected for the first time in HI. There is no indication of an interaction between these galaxies in our data, despite their small angular separation, and almost identical velocities. Another nearby member of the group, NGC 4274, an S0a galaxy at an angular separation of 20′, also has quite a low HI mass and regular velocity field in the atomic gas. Thus, there is no obvious donor for the unusual amount of HI detected in NGC 4278.

The velocity field of the atomic gas in NGC 4278 seems to be extremely regular, yet implies noncircular motions for the gas in the central regions. We plan to compare our HI data to optical observations of the ionized gas and stars, and, also using photometric data, to develop a kinematical model to constrain the three-dimensional density distribution in the galaxy.

Session 56: Sun III
Oral Session, 10:00–11:30 am, Salon I

56.01
How the Hillock Model Explains the Dark Appearance of Faculae in the Infrared Near Disk-Center and the Blanketing of Sunspots
K. H. Schatten, H. G. Mayr (NASA/GSFC)

We apply the formula provided in the Schatten et al. (1986) paper on the contrast of faculae, using a hillock model, and show that the formula, given by:

$$\Delta C = \frac{(\tan \alpha \Delta \beta)^2}{2 (1 - \mu^2)^2} \frac{b_3 + 3B_\mu}{\mu LD(\mu)}$$

previously published, provides a dark contrast near disk center at infrared wavelengths. The contrast of the hillocks, equation (1), is proportional to the expression (1 + 2B_μ), which changes sign in the infrared. Allen (1973), based upon the observations of Bonnet(1968), provides limb darkening coefficients of B_0 = 0.57 and C_0 = -0.21, (B_0 = 0.64) for a wavelength of 1.5 nanometers. Near disk center, where μ is near 1, this expression equals -0.06, whereas at visible wavelengths the expression is positive and near 0.2, showing that the hillock model for faculae provides a dark contrast in the infrared. Recently, Foukal et al. (1989) have shown that the facular contrasts in the infrared do have negative values (they appear dark). They report a dark contrast for faculae at 1.65 mm near μ = 0.85, thus their observations appear to support the hillock model.

In addition, we provide further support for the hillock model by showing facular hillocks can block the appearance of sunspots, which are behind them. We show that both the number and area of sunspots decrease, as active regions approach the Sun's limbs, when faculae are large, but not when faculae are small. The decrease in total area observed, is not the Wilson effect, since this influences only the relative sizes of penumbral areas due to geometric foreshortening and does not affect the projected total area. The data are inexplicable, unless we allow that the faculae are blocking the appearance of the sunspots behind them. Facular hillocks could do this, but facial wells could not.

56.02
Transition Region Massflows Associated with Sunspots

From spectrograms taken with the High Resolution Telescope and Spectrograph (HRTS) it appears that strong mass flows through the transition region are commonly associated with sunspots. The flow patterns change over minutes and days, but the flow appears always to be present. Most characteristic are regions with supersonic downflows, but upward flowing gas is likewise seen with generally smaller velocities. There is, however, an apparent lack of balance between up- and downgoing massflux. Another characteristic property is the presence of several distinctly different flow speeds within the one arc second resolution element of HRTS. These multiple speeds persist through the temperature layers in the transition region at nearly unchanging speed and are particularly obvious in the regions of prominent downflows. Multiple speeds are also present in areas with upflows except at some locations inside the spot, where only a single velocity component is seen.