Rotation measures in the northwest region are ~80 rad m\(^{-1}\) greater than those in the southeast. This result, together with the asymmetric Doppler shifts of X-ray emission lines (Markert et al. 1983), implies that most of the radiation from the northwest region of Cas A originates on the far side of the remnant. This rotation measure difference provides additional support for the model of Cas A as a clumpy, expanding ring of matter tilted with respect to the line of sight.

02.07
A Search for Atomic Hydrogen Associated With Planetary Nebulae and Evolved Stars
P.R. Silvergate (Perkin-Elmer Corp.), S.E. Schneider (Cornell Univ.), D.A. Altschuler (Univ. of Puerto Rico)
We searched 25 planetary nebulae and evolved stars for associated atomic hydrogen using the Arecibo Observatory 305 meter radio telescope. Only objects whose radial velocities provided discrimination against galactic atomic hydrogen emission were chosen for observation. Atomic hydrogen was definitively detected from only one planetary nebula, IC 4997 (in absorption).

The absorption is associated with the expanding shell of the nebulae, and the mass is \(\sim 0.1 \ M_\odot\). Upper limits were derived for the mass of atomic hydrogen associated with the other objects. In particular, the upper limit to the atomic hydrogen mass associated with IRC 10420 indicates this F supergiant is rapidly evolving; its age as a F supergiant is less than 400 years.

02.08
Evolution of Model Planetary Nebulae
M. Bobrowsky (U. Maryland)
Numerical models of planetary nebulae have been calculated for a variety of initial conditions. We vary the temperature of the central star, its evolutionary time-scale, the density distribution, and the average density in order to assess the importance of the initial conditions on the final appearance of the nebulae. The nebula starts out cold and molecular. Dissociation of the molecules then occurs by two mechanisms. Firstly, low energy photons excite the molecules to upper electronic states and then they cascade down, sometimes to the vibrational continuum of the ground electronic state leading to dissociation. Secondly, upon arrival of the ionization front, the molecules can be ionized and then dissociate upon recombination. A shock can be seen to propagate through the gas after the ionization front becomes B-type, although the enhanced density, temperature, and velocity at this point are short-lived. The final density of the gas falls off at the inner and outer boundaries as this material expands away from the rest of the nebula and the velocity of the gas generally becomes almost linear with radius.

The computer time for this work is provided by the Computer Science Center of the University of Maryland.

02.09
Kinematical properties of High Velocity B-stars
P.K. Lu (Western Ct. St Univ. and VRO)
High radial velocity and large proper motion bright B-stars were analyzed for search early-type runaway stars. A total of 3001 B-type stars (including A0) selected from the Yale Bright Star and Supplement Catalogue. 376 of these stars with \(\pm \epsilon_{\nu} > 200 \text{km/sec} \) and \(\nu > 830 \text{km/sec} \) in the halogenized sample. The total number of stars with \(\nu > 830 \text{km/sec} \) and \(\epsilon_{\nu} > 830 \text{km/sec} \) may be classified as halo population. 13 of them have giant to supergiant luminosity, thus spectroscopic distances of these stars are very certain. Only 8 stars have the reduced proper motion B5 magnitude may be classified as possible runaway stars.

The study shows the following results: 1. For large proper motion stars, the distribution of UVW and b(II) is consistent with the number of large number of B-stars located at high galactic latitude yet they have small z-distance from the galactic disk. 2. For high radial velocity stars, there are very few B-stars at high galactic latitude but with relatively large z-distance. 3. For large UVW-velocity stars, both the b(II) and z -distributions are very similar to the high radial velocity stars. This study suggests that the selection of runaway stars based on their large proper motion and location in the galaxy is not justified.

Session 3: Normal Galaxies
10:30–12:00 (South Meeting Room)

03.01
Are Cloud–Cloud Collisions Necessary For Global Spiral Structure?
W.W. Roberts, Jr. and G.R. Stewart (U. Virginia)
We present further results of our cloudy-ISM model of spiral galaxies (Roberts and Hausman, 1984 [Ap. J., 277]; Hausman and Roberts, 1984 [Ap. J., 282]). The ISM is simulated by a system of particles, representing gas clouds, which orbit ballistically in a spiral-perurbed, galactic gravitational field, collide inelasticly with one another, and give birth to and subsequently interact with young stellar associations. Star formation is triggered by both cloud-cloud collisions and supernova remnant interactions. Current results further substantiate the revelation from our earlier work that the size of the collisional mean free path of the cloud system has very little effect on the sharpness and degree of concentration of the cloud distribution in spiral arms and little effect on the coherence of the global spiral structure. Results are presented for a sequence of cases in which the disk-averaged collisional mean free path ranges from a lower bound of 200 pc to the extreme collisionless upper bound of infinity. Pronounced global spiral structure is found over the full range of cases, even the extreme collisionless case. We conclude that "orbit crowding" ("gas streamline crowding") is playing a major role in the gravitationally-driven formation of spiral structure. Cloud–cloud collisions in turn act to shift the phase of the large-scale galactic shock waves that form. As a mechanism for star formation, cloud–cloud collisions play a central role in the global spiral distribution of young stellar associations. The relative importance of cloud–cloud–collision–induced star formation versus SNR–induced (sequential) star formation is discussed. The physical processes underlying sequential (SSSP) star formation are illustrated via our dynamical cloud/particle model. This work was supported in part by the National Science Foundation through Grant AST–82–04256.

03.02
Hydrodynamic Theory of Galactic Shocks in a Clumpy ISM
G.R. Stewart and W.W. Roberts, Jr. (U. Virginia)
The intrinsically clumpy nature of the interstellar medium (ISM) has motivated recent numerical simulations of spiral galaxies in which the ISM is modeled as a population of discrete clouds/particles. These cloud/particle simulations typically produce spiral arm shock structures that are broader and less intense than the idealized shocks that were previously calculated from asymptotic continuum equations. We are trying to bridge the gap between these two approaches by formulating a generalized hydrodynamic description of the cloud/particle model. The usual fluid equations are generalized by allowing the pressure tensor to be a separate dynamical variable. Viscous stirring due to cloud–cloud collisions and stellar winds is modeled by a simple relaxation term in the dynamic equation for the pressure tensor. In special cases, the generalized hydrodynamic description can be reduced to the Navier-Stokes equations in which the effective viscosity explicitly allows for the finite relaxation time of the pressure tensor. These modified fluid equations provide an alternate and complementary method to the cloud/particle simul-