ANALYTICAL MODELS OF PROTOPLANETARY DISKS IN THE ORION NEBULA

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We have constructed analytical models of the gaseous objects in the Orion Nebula variously referred to as partially ionized globules (PIGs), LV globules, and protoplanetary disks (proplyds). We are applying these models to the *HST* observations of proplyds published since 1993 by various groups, and finding that we can constrain certain structural parameters for the proplyds.

The proplyds are modeled as isothermal objects whose particles are in Keplerian orbit around the central stars, and whose structure normal to the orbital plane is due to hydrostatic equilibrium. Our use of the term "disk" does not mean that the proplyds are necessarily thin and flat.

We consider how the size of a proplyd can be limited by the effects of the radiation field of Theta1C Orionis, the principle ionizing star in the Orion Nebula. Making the assumption that certain subsets of the observed proplyds obey similar surface-density power laws allows us to constrain the parameters in those laws. This approach is also of interest because it does not require one to assume optical thicknesses for the proplyds.

Our detailed results will be published in the near future.

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HST PARALLEL WFPC2 IMAGERY OF THE CARINA NEBULA: EGGS(?) AND PROPLYDS(?) IN DARK CLOUD RIMS AND BOK GLOBULES

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As part of the *HST* GO-6042 program, parallel WFPC2 images of locations in the large Carina H II region were taken during a series of FOS spectra of several ejecta of Eta Carinae (see Glover et al., these proceedings). The observations were scheduled during two CVZ (continuous viewing zone) visits in 1995 October, enabling deep WFPC2 exposures to be taken in ten filters. The "serendipitous" target was an area which included the Cr 232 star cluster and surrounding H II region, about 8 arcmin to the NW of Eta Carinae itself. Images of the nebula were obtained in the filters F656N (Hα), F673N ([S II] 6717+31 Å), F658N ([N II] 6583 Å), F502N ([O III] 5007 Å), and F547M (continuum) to study the ionization structure. In addition, relatively long ($\sim$ 1000 sec) exposures were obtained though the wide-band filters F336W, F439W, and F555W for purposes of obtaining UBV magnitudes and colors of stars down to a limiting magnitude of V$\sim$ 25.

We present the results of this imagery in the form of (*a*) color-coded emission line ratio maps of the nebulosity in the various lines noted above, and (*b*) color-magnitude (CMD) and color-color diagrams of stars in the field. At a distance of 2500 pc for the nebula and cluster, the spatial resolution of 0.1 arcsec on the WFPC2 imagery corresponds to 250 AU per pixel, a scale that resolves numerous Bok globules not previously seen from ground-based imagery. These globules are seen in absorption in the [O III] images and with bright rims in [S II] and [N II], indicating their proximity to the cluster OB stars and location in the ionized volume of the nebula. Our CMDs, (very preliminary) reach $M_V\sim+11$ for stars at the distance of the Cr 232 cluster. A prominent reflection nebula is also seen around one of the stars in the cluster.

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COROTATION RADII IN SPIRAL GALAXIES

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Shock induced star formation in a stellar density wave scenario produces an azimuthal gradient of ages across the spiral arms which has opposite signs on either side of the corotation resonance (CR). Schweizer (1976) and Beckman & Cepa (1990) have previously discussed what would be the behavior of the colors across spiral arms when the shock generated by a spiral density wave (SDW) induces star formation. The main azimuthal observable characteristics of this scenario are steeper azimuthal profiles and bluer color indexes on the side where the shock front is located. Elmegreen, Elmegreen, & Montenegro (1992) also pointed out that such evidence for the CR is clear in gas-rich galaxies in the form of sharp endpoints to star formation ridges and dust lanes in two-armed spirals. In a previous paper (Puerari & Dottori 1992), we proposed a method to determine the leading or trailing character of the density wave perturbation in spiral galaxies by analyzing the distribution of H II regions. We idealize a new method based on the Fourier analysis of azimuthal profiles, to locate the CR and determine the arm character (trailing or leading) in spiral galaxies. Basically, we compare the behavior of the phase angle of the two-armed spiral in blue and infrared colors that pick out, respectively, young and older disk stellar population. The full paper of this poster contribution was published elsewhere (Puerari & Dottori 1997) and the reader can get more information on that paper. With our new method we confirm for NGC 7479 the existence of the leading pattern with CR at the extreme of the bar. We found in this galaxy the existence of a internal CR, indicating a trailing pattern. NGC 1832 presents three CRs, the inner and the outer ones indicate leading pattern and the intermediate CR, a trailing one. The most plausible physical interpretation for this situation is the existence of two pattern speeds.

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NASA 3.0-M LIQUID MIRROR TELESCOPE

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We have constructed a 3.0-meter aperature zenith-staring telescope of an unusual nature. This Liquid Mirror Telescope (LMT) has as its primary mirror a spinning container of elemental mercury (Hg). We rely on the well-known principle that the equillibrium surface configuration of a rotating fluid is a paraboloid (if the axis of rotation is parallel to a uniform gravitational field). In our configuration, the primary container supports a 1.8 mm film of Hg and rotates on an air bearing spindle at 10 rpm, yielding a focal length of 4.5 m (f/1.5). A Wynne-type corrector removes aberrations and produces a 6 cm diameter, 0.64 deg focal plane at prime focus. Optical throughput is 65% allowing for the 78% reflectivity of Hg at visible wavelengths. Corrector distortion has limited resolution to 0.95 arcsec FWHM. Atmospheric seeing at the telescope's location (National Solar Observatory, Sunspot, NM) yields a nominal resolution of 1.3 arcsec (″) FWHM. After a corrector fix in late 1997, we expect to obtain 0.5″ FWHM images with good seeing.

The LMT was constructed with the purpose of characterizing the orbital space debris environment for NASA and conducting very wide/deep field astronomical surveys. Project costs were 1.2 M$ or 5% of the estimated cost for a conventional (glass/pointable) 3.0-m telescope. Since March 1996, we have obtained 100+ hrs of orbital debris observations with various image intensifiers. The present debris detection size is < 4 cm at 1000 km assuming a 0.1 albedo spherical reflector. For the astronomical survey, we are using a Ford 2K thick CCD with 15 um pixels yielding a 0.6″ pix^{-1} plate scale. The CCD is used in Time Delay Integration (TDI) mode wherein we drift scan at the sidereal rate to yield a 97.0 sec exposure time over a 20 arcminute FOV. To date, we have obtained (BVRI) and narrowband (400–1000 nm; 10–30 BW) photometry over 40+ sq. degrees of sky at high galactic latitude centered on +33° Dec. The accumulating data set (200+GB) is being used primarily to generate a wedge diagram extending to a redshift of 0.5 over 10 hrs of Right Ascension and containing approximately 1.5 million galaxies/QSOs; the largest survey of its kind by any telescope to date.

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EVIDENCE FOR SATURATED INVERSE COMPTON SCATTERING IN GAMMA-RAY BURSTS

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Early studies of gamma-ray bursts found that the low-energy (30–100 kev) asymptotic spectral slope was typically 0 to -1.5 (Band et al. 1993). However, we examined the time-resolved low-energy GRB spectra measured with the Burst and Transient Source Experiment (BATSE) and found that the asymptotic power slope is often positive (as high at 1.6 ± 0.3) near the beginning of a burst and becomes negative as the burst progresses (Crider et al. 1997). These findings rules out many proposed emission mechanisms but can naturally be explained with saturated Comptonization as an emission mechanism in GRBs. By running Monte Carlo simulations, we