Based on image measurements alone, this body has a mean motion of 626.0 ± 0.1 deg/day. This value will be improved considerably once the body is found in the Voyager 1 data set. Its disk-integrated I/F is 141 ± 14 km^2. Assuming a radius of 8–11 km (based on the Showalter et al. mass determination and a water ice density), this body has a geometric albedo in the range 0.4–0.7; this is very similar to values for the other inner Saturnian moons. Small but apparently significant discrepancies between the predicted and observed orbits may help us to understand the subtleties of gravitational wake patterns and the "shepherding" process in general. In addition, improved orbit information may be used to more accurately pin down the ring's absolute radial scale near the Encke Gap, and also to shed light on the relationship between the moon and several faint ring arcs detected within the gap.

04.03

Saturn Pole Position and Ring Radius Scale From 28 Sgr Occultation

W. Hubbard, C. Porco, R. Clark, E. Turtle, V. Haemmerle, D. Hunten, G. Rieke, M. Rieke, J. Haller, J. Holberg, L. Lebofsky, R. Marcialis, D. McCarthy, B. McLeod (U. of Arizona), M. Buie (STSCI), J. Elias (CTIO), D. Jewitt (U. of Hawaii), E. Persson, T. Boroson, S. West (MWLCO), R. Landau, L. Carrasco (Obs. San Pedro Martir)

We have determined Saturn's pole position and the radii of twelve circular edges in the C-ring (radii = 84750 to 90615 km) and of the Encke gap (133424 and 133745 km) from high-precision timings of the 3 July 1989 occultation of 28 Sgr. Because our data set so far includes one southern hemisphere station (CTIO) and four northern hemisphere stations (three Tucson-area stations plus San Pedro Martir), a terrestrial chord separation ~ 10000 km is available, which permits simultaneous solution for ring radii as well as position angle and opening angle of the apparent ring ellipses. 28 Sgr appears to be well represented as a uniformly illuminated disk with an apparent radius of 9.6 ± 1.2 km projected at Saturn at the wavelengths of observation (~ 3μm). The internal consistency of the data set and redundancy of stations indicates that the positional error of a given sharp ring edge timing is at the level of 2 km or smaller. Although we have so far analyzed only one southern hemisphere station, the CTIO data are of substantially higher signal/noise than the others, and have an internal consistency at the level of 1 km or smaller.

We confirm the revised ring radius scale of Nicholson, Cooke, and Pelton (1990, submitted), which reduces the Voyager RSS scale by several km, *but* we obtain a substantially different pole position. Our best-fit pole lies 0.071 deg east and 0.015 deg south of the pole of Nicholson *et al.*, and the difference is significant. Our pole is closer to pre-Voyager determinations than is the pole of Nicholson *et al.* or of Simpson *et al.* (*AJ* **88**, 1531-1536, 1983).

Our solution yields a determination of the location of the center of Saturn with respect to the stellar image to an accuracy of a few km, and gives the relation between universal time and ring plane pierce point for any observation station. This solution is available on request to others analyzing 28 Sgr data.

This work has been supported by NASA grants NAGW-1555, NAGW-1876, and NSF grant AST-8715373.

04.04

The KINEMATICS of SATURN'S MAJOR NARROW RINGS from COMBINED VOYAGER and GROUND-BASED DATA

E. Turtle, C. Porco, W. Hubbard, V. Haemmerle, R. Clark, D. Hunten, G. Rieke, M. Rieke, J. Haller, J. Holberg, L. Lebofsky, R. Marcialis, D. McCarthy, B. McLeod (U. of Arizona), M. Buie (STSCI), J. Elias (CTIO), D. Jewitt (U. of Hawaii), E. Persson, T. Boroson, S. West (MWLCO), R. Landau, L. Carrasco (Obs. San Pedro Martir)

University of Arizona observations of the 3 July 1989 UT occultation of 28 Sgr by Saturn's ring system were taken in both standard single aperture and rapid two-dimensional imaging experiments made from a network of observing sites distributed over the globe. The aperture observations made at the MMT (λ3.17μ), the Catalina 61" (λ3.4μ), the CTIO 4 meter (λ3.4μ), and the San Pedro Martir 2.1 meter (λ3.20μ) have been reduced and examined. The precision of relative feature locations in the 28 Sgr occultation data is ~ ±2 km, comparable to that in the best Voyager data.

The ground-based observations of the narrow eccentric Colombo (1.291 R_S), Maxwell (1.450 R_S), and Huygens (1.953 R_S) rings have been combined with Voyager imaging and occultation data. Ring precession rates are now precise to a level of ~ 0°.005 /day, roughly a factor of ten improvement over previous work. The best-fitting shape and kinematical models for these rings will be discussed. This work has been supported by NASA grants NAGW-1876 and NAGW-1555.

04.05

Spatial Scales in Saturn's B Ring

L.J. Horn (JPL/Caltech) and J. N. Cuzzi (NASA/Ames)

We report progress in our study of the spatial scales of structure in Saturn's B ring. Radial scans of ring brightness derived from a series of high resolution Voyager images, with resolution of 3.5 km/pixel, were studied using a non-linear spectral analysis technique, Burg 2, on the data. This technique was used to determine the spatial frequency spectrum, and thus the distribution of characteristic length scales, in the B ring. Overall, the structure shows no truly periodic structure. However, a large amount of the B ring does display significant non-random structure appearing as features with roughly equal or slowly varying width and spacing. Our spectra leave little doubt that there are characteristic spatial scales in the inner and outer B ring that are not noise-like, and that the spatial scales vary between the inner and outer B ring. Features exhibit scale sizes ranging from about 100 km in the inner portion of the B ring (BAAS 21, 928 (1989)) to a mixture of larger (about 300-400km) and smaller (20-50km) scales in the middle and outer B ring. An understanding of the variation in length scale with location in the rings may constrain the physical processes which are operating there.

04.06

D – Ring Features and f – Mode Oscillations of Saturn

M. S. Marley (NASA/Ames) and C. C. Porco (Univ. of Arizona)

We (Marley *et al.* *BAAS* **21**, 1989) have previously reported possible associations between Outer Lindblad Resonances (OLRs) of low degree Saturnian f-mode oscillations and C-ring wave and gap features. Locations of $m = \ell - 1$ Outer Vertical Resonances (OVRs) generally fall in the D-ring. We have measured the locations of three features seen in Voyager D-ring images. A prominent narrow feature at 71695 km is seen at both high and low phase angles; the remaining two features are seen clearly only in high phase angle images.

When the radii of these features are compared with predicted planetary oscillation mode OVR locations, fair agreement (see table) is found. This may provide evidence of an association between the resonances and the D-ring features. Also an unassociated wave near the inner edge of the C-ring lies at another OVR location. This wave has been identified by Rosen (*in press*) as being forced at either an OVR or ILR with $m = 2 - 3$; but since this wave is the weakest unassociated wave found in the C-ring, the m assignment may be inaccurate. Our model predicts $m = 4$ at this location. Whether or not these OVRs are responsible for the ring features requires further investigation. If these and the other previously reported ring resonances are confirmed, however, very accurate measurements of mode frequency splitting will be possible.

OVR and Ring Feature Locations

Mode	OVR Radius (km)	Feature	Location (km)
2f	68900 ± 700	narrow	67575±40
3f	71070 ± 500	narrow	71695±40
4f	73070 ± 450	broad	73090±150
5f	74820 ± 400	wave	74945