3.5-CM IMAGING OF THE MERCURY NORTH POLAR RADAR-BRIGHT FEATURES. M. A. Slade[1], L. J. Harcke[2], R.F. Jurgens[1], J.K. Harmon[3] H. A. Zebker[2] and E. M. Standish[1], [1]JPL/Caltech, 4800 Oak Grove Dr., Pasadena, CA 91109-8099; [2]Stanford University, Stanford, CA 94305-9515; [3]NAIC/Arecibo, Arecibo, PR 00613

In July 1999, the first Goldstone full-disk radar imaging of Mercury using the "random-long-code" (RLC) technique succeeded in producing images of the north polar radar-bright features at 3.5-cm wavelength. This technique, developed and implemented at Arecibo (Harmon et al., 1992), uses extremely long pseudonoise (PN) sequences (periods $\sim 2^{40}$ bauds) which exhibit no periodicity over the much shorter time of observation, and result in images which avoid the overspread aliasing of normal PN codes (Harcke et al., 2000).

An extensive Mercury campaign had been laid out; most of the Mercury antenna time was given up for observations of a newly discovered near-Earth asteroid. Nevertheless, the two days of Mercury RLC observations show some tantalizing results which will require further observation to quantify and extend their applicability.

As has been seen at Arecibo at 13-cm, the new 6-km resolution 3.5-cm images show radar-shadowing of central peaks and concentration of radar-bright deposits under crater south rims in sun-shaded crater floor areas (see Fig. 1). The 3.5-cm features are, in general, less radar-bright than the corresponding 13-cm images.

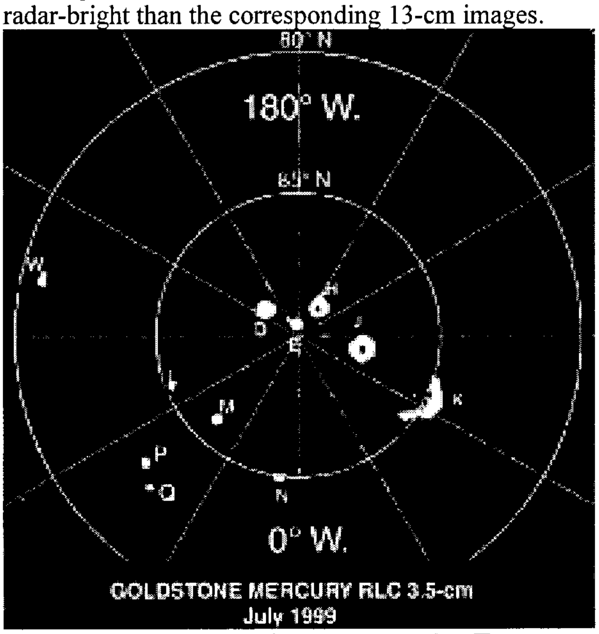

Figure 1. Radar-Bright North Polar Features

This radar-albedo decrease is most simply explained by attenuation in the regolith covering the features, since the path through the regolith (and then back to Earth) is thicker in wavelengths than at 13-cm. Future carefully calibrated observations can likely measure regolith cover thickness, and determine if there are spatial variations to the cover thickness.

Another significant difference is the circular polarization ratio μ_C found at 3.5-cm and 13-cm. For features K and J (see Harmon, Perillat, and Slade, 2000), the ratio at 3.5 cm is 1.8 ± 0.2, while these features have μ_C of 1.3 ± 0.05 at 13-cm. Again a simple physical model for this difference is that the pathlength in the medium producing coherent backscatter (see Peters, 1992) is 4 times longer in wavelengths. Thus more photons can be backscattered before absorption at the end of the coherent backscattering layer. If the medium is H_2O ice, the along-path length of the ice deposit may be able to be determined (H_2O ice is the only relevant material for which we know the loss tangent at microwave frequencies). Various incidence angles over multiple inferior conjunctions might in addition put constraints on the thickness of the deposits.

Future RLC observations of Mercury at 3.5-cm will also produce images of the hemisphere unimaged by Mariner 10. Comparison between the 13-cm and 3.5-cm maps may shed light on the nature of a large feature near 57 deg N., 343 deg W. , which has been hypothesized to be a possible shield volanco (Harmon and Slade, 1995).

For the immediate future, Goldstone observations will focus on the South Polar features, since they will not be accessible to Arecibo observations for ~ 12 inferior conjunctions. Goldstone Mercury observations are currently scheduled for Feb. 19, 20; 27, 28, and 29, 2000, which should result in the first "high" resolution images of these features. While the South Polar features do not appear as interesting a priori as the North, Mercury observations have been a history of surprises.

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