

Harrison

STUDY PLAN FOR 1967/68

During the academic year 1967/68 I intend to continue work on my thesis, "Temperatures of the Terrestrial Planets", under the direction of Dr. Carl Sagan. I hope to complete the work for my Ph.D. degree by June, 1968.

My work on thermal models of the planet Mercury has progressed smoothly, resulting in the completion of a set of computer programs to generate disk-integrated radio and infrared brightness temperatures as a function of wavelength and the celestial mechanical variables phase angle and heliocentric longitude. Models have been computed for the case of temperature-independent thermal properties of the subsurface, and I am now investigating more advanced models which include radiative conduction effects. Preliminary results for the temperature-independent case are presented in a paper, "The Microwave Phase Effect of Mercury", now accepted for publication in the Astrophysical Journal. In this paper, Dr. Sagan and I show that the 2-cm phase curve is well represented by models in which a generally lunar character is assumed for the subsurface of Mercury.

I have submitted for publication a letter, "On the Interpretation of Mercury Observations at 3.4 and 19 mm", in which the data of Epstein are shown to be consistent with the 2 cm phase curve using my models. This brief paper responds especially

to the recent report by Gary (Ap. J. Letters, in press) that these two sets of data are inconsistent; Gary made a number of simplifications and assumptions which I am able to remove. Dr. Sagan and I are currently preparing a paper on the temperature-dependent thermal models to be presented at the December AAS meeting.

I have made observations of Mercury myself at a wavelength of 2 cm using the 140-ft telescope at the National Radio Astronomy Observatory and the 120-ft telescope at Haystack. I have data from June and September, 1967, and I will be observing again in November and possibly also in April, 1968. Other data which I expect to have access to by the beginning of 1968 are an improved series of observations at 3.4 mm by Epstein and a long series of measurements at 4 cm made at Michigan by Klein. With this large body of data and my set of operating programs I hope to be able to do a fairly thorough analysis of probable thermal properties of Mercury and to present this completed investigation as a major part of my thesis.

My work on Mars is practically finished and will be prepared for publication this fall or winter. I have demonstrated that it is not possible to fit the infrared data of Sinton and Strong with a single-layer thermal model, even allowing for possible effects of the Martian atmosphere. Following a suggestion of Frank Drake, I am constructing two-component

models representing a mixture of rocky and granular materials near the planetary surface. I expect to discuss the resulting models in terms of plausible surface material and values for atmospheric conductivity for Mars, taking into account recent work on the significance of erosion by meteoric impact and by wind-blown dust.

I now have observations of the 2 cm radio flux from Venus at several phase angles. Using the NRAO 140-ft telescope I observed in April and June when Venus was a declination $+20^\circ$. In August I began a series of observations with Venus at $+2^\circ$ declination which will extend through almost 180° of phase angle. I will observe again in November and in April of 1968. I am comparing the 2 cm flux from Venus with measurements made of the sources 3C123 and 3C274 which are thought to be non-variable. I am also observing the variable sources 3C84 and 3C273. All observations are made by mapping the source to minimize errors due to variation of telescope gain with hour angle, declination and focus.

I have also made several polarization and flux measurements with the Haystack Facility 120-ft telescope, and these may be continued if adequate telescope time is available. In any case, I expect the Venus section of my thesis will be the last part completed, especially since my conclusions will depend on the data obtained in the spring of 1968.

In addition to the above thesis work, I hope during the 1967/68 year to prepare for publication earlier work I have done on the eclipsing binary star BV357 and on the hypersensitization of infrared photographic emulsions. I shall also be involved with the continuing program of the SAO Planetary Camera Project.