which can give rise to novae. The "flash" nova, e.g., T Coronae Borealis, has a very fast rising and falling light curve and a rapidly decreasing velocity curve. A shock wave which imparts a velocity which is greater than the escape velocity to the outer layers of the star will produce this behavior. A less rapid rising and falling light curve and a nearly constant velocity are characteristic of the "ordinary" novae, e.g., GK Persei. These features will result when the stellar material is forced outward from the star by an increase of pressure in the region where the internal energy is injected.

This work was based on portions of a thesis submitted to the Graduate School of Indiana University in partial fulfillment of the requirements for the Ph.D. Work performed in part under the auspices of the Los Alamos Scientific Laboratory.

Stellar Spectrophotometry from a Pointed Rocket

T. STECHER, *Goddard Space Flight Center*.—A 13-in. telescope with an attached spectral scanner has been successfully flown on Aerobee rockets four times. The instrument and attached rocket has been pointed at individual stars with an accuracy of from 10 to 30 sec of arc depending upon the stellar magnitude. The control system consists of a gyroscope inertial reference system with coarse gas jets and a star tracker to control with fine jets. The telescope and scanner are F-10 systems. Three exit slits are used simultaneously and together cover the spectral range from $\lambda 1100$ to $\lambda 4000$ with considerable overlap. Two scans of each programmed star are made in 40 sec. The resolution in two flights was 10 Å and two 5 Å. A continuous aspect signal allows a wavelength correction to be made at each point in the spectrum. Digital processing of the telemetry is used throughout.

The observing programming has attempted to provide a broad survey of O, B, and A stars of varying luminosity types. A number of resonant lines have been observed in both emission and absorption. Equivalent widths are now being measured along with estimates of total blanketing. Measurement of the continuous stellar flux and interstellar phenomena is also discussed. As many representative spectra as time will allow are shown.

Lunar Occultations of the Radio Sources 3C15, 3C245, and MSH 12+04. J. SUTTON, C. HAZARD, AND S. GULKIS, *Arecibo Ionospheric Observatory*.—Structures and positions are derived for these sources, based primarily on occultation observations using the 210-ft radio telescope at Parkes, and supplemented by further measurements with the 1000-ft and 140-ft instruments at Arecibo and

Green Bank, respectively. Preliminary accounts of the Parkes results have already been published by Hazard, Mackey, and Nicholson (*Nature* **202**, 277 1964).

3C15 consists of four components situated along a straight line at position angle 160° . The half-power diameters are approximately 3" and the relative intensities are 2, 2, 3 and 1. The accurate position of the associated galaxy (Veron, *Astrophys. J.* **144**, 861, 1966) is significantly displaced from the axis of the radio distribution, indicating either a peculiar relationship between radio and optical distributions, or else an incorrect optical position. MSH 12+04 is resolved into three components, each approximately 15" in diameter. They are distributed essentially along a straight line, the outer components being 3'.6 and 1'.1 from the central one. Identifications with a 17^m5 galaxy and a 19^m object are suggested for two of the sources. The third lies in an empty field on the Sky Survey prints. A recent occultation of the quasi-stellar radio source 3C245 provides further evidence that its radio structure is similar to that of 3C273 (Hazard, Sutton, and Mackey, Proc. 4th Texas Symposium on Relativistic Astrophysics) i.e., a small diameter, flat-spectrum component coincident with the optical object, and a broader component 5" away having a normal spectrum.

The Arecibo Ionospheric Observatory is operated by Cornell University with the support of the Advanced Research Projects Agency under a research contract with the Air Force Office of Scientific Research.

An Analysis of Infrared Observations of Cometary Continua. K. S. KRISHNA SWAMY AND BERTRAM DONN, *NASA/Goddard Space Flight Center*.—

Observations of cometary continua in the infrared which depend upon thermal emission from grains are a powerful supplement to deductions concerning the nature of grains from light scattering in the visible. The method employed here, using Mie theory calculations, should also be used for analysis of infrared measurements of the zodiacal light. For several grain types with radius a and refractive index $m = n - ik$, the absorption cross section and angular scattering cross sections appropriate to the angles of observation are calculated. The thermal emission $F_\lambda(a, m, T_g)$ can be calculated. The total solar energy absorbed and total re-emitted thermal radiation can be determined. Equating these two quantities establishes the grain temperature. This determines a theoretical cometary flux distribution which may be compared with observed data and should give a reasonable fit for an acceptable model. Observed variations with heliocentric distance