it is unlikely that such H II spikes will reveal dark masses or intergalactic hydrogen clouds.

Total Continuous Absorption Coefficients for Complex Atoms. GILLIAN PEACH (introduced by G. Westerhout), *University of Maryland*.—Recently, (Peach, *Monthly Notices Roy. Astron. Soc.* **130**, 361), a general formula has been derived to calculate free-free absorption cross sections in the field of positive ions. This assumes that the free electron is moving in a central potential and the nonhydrogenic contribution to the phase is calculated by extrapolating the quantum defects of the observed energy levels into the continuum. A similar formula for photoionization cross sections was developed by Burgess and Seaton (*Monthly Notices Roy. Astron. Soc.* **120**, 121), and has now been revised by the author. In this paper a general program is described which calculates total continuous absorption coefficients for neutral atoms or positive ions, and which makes allowances for the nonhydrogenlike behavior of the atoms for small values of the angular momentum l of the outer electron by using the general formulas for bound-free and free-free transitions. A Boltzmann distribution is assumed for the relative populations of the discrete energy levels and a Maxwell distribution for the continuum energies. Good agreement is obtained with experiment for nitrogen and oxygen in the visible region of the spectrum, but the agreement obtained for chlorine is less satisfactory.

Measurements of Radiation from the Galactic Disk at 4080 Mc/sec. A. A. PENZIAS AND R. W. WILSON, *Bell Telephone Laboratories, Inc.*.—A total of some 30 drift scans, each between 2 and 3 h in length, were made across the galactic disk at five declinations (8.2° , 2.7° , -6° , -19.2° , and -25.5°) selected for freedom from discrete sources. The observed peak brightness temperatures ranged from 0.6° to 1.4°K . The smallest features that could be reliably observed on individual records were of the order of 0.05°K , or about 10 times the rms noise. This sensitivity permits us to compare our results with declination cuts made from lower frequency maps without any serious degradation in accuracy arising from the relative weakness of the radiation at 4080 Mc/sec.

The above work was performed with the 20-ft aperture horn reflector antenna at the Crawford Hill Laboratory, Holmdel, New Jersey; it has a beamwidth of 0.7° at 4080 Mc/sec. The traveling wave maser radiometer used has been described previously. All observations were made with the

antenna stationary, using synchronous comparison with a liquid-helium-cooled waveguide termination.

Effects in the Two-Color Diagram of the Rotation of A and F Stars. JAMES G. PETERS, ARTHUR I. POLAND, AND MARSHAL H. WRUBEL, *Indiana University*.—The method described by Collins (*Astrophys. J.* **138**, 1134, 1963) for computing the observed radiation of rotating stars as a function of angular velocity and inclination, has been extended to include departures from grayness. Computed displacements of rotating A and F stars in the two-color diagram are compared with earlier observations (Kraft and Wrubel, *Astrophys. J.* **142**, 703, 1965).

Balloon Observations of X Rays from Scorpius and from the Crab Nebulae. LAURENCE E. PETERSON AND ALLAN S. JACOBSON (introduced by G. Burbidge), *University of California, San Diego*.—Balloon studies of the x-ray sources in Scorpius and the Crab Nebula have been made over the energy range from 10 to 200 keV (1.0 to $0.05 \text{ \AA}$). The observations were made at 130 000 ft (3.0 g/cm^2) with an instrument of improved collimation and background properties. The detector consisted of a thin NaI scintillation counter surrounded by a 2 cm thick cylindrical CsI scintillation shield connected in electrical anticoincidence. The detector area is 9.2 cm^2 ; its solid angle is 0.2 sr . Each event is measured with an 128 channel pulse-height analyzer, and telemetered in a digital format suitable for computer reduction. During a balloon observation the detector is fixed in elevation, and controlled in azimuth so that an object making a meridian transit passes through the aperture. The background spectrum to be subtracted is therefore obtained before and after the transit. At 130 000 ft most of the background counts are due to x rays produced by cosmic rays in the air mass above the forward aperture of the detector. The Scorpius source was observed on 18 June and 14 September 1965, the Crab Nebula on 23 September 1965. The Scorpius source was significantly above background over the range 18 to about 50 keV. Correction for atmospheric attenuation gives an exponential spectrum to about 40 keV, characteristic of a hot thin gas at $50 \times 10^6 \text{ }^\circ\text{K}$. This is in general agreement with Chodil *et al.* (*Phys. Rev. Letters* **15**, 605, 1965) who have obtained results below 20 keV. The Crab Nebula spectrum is 60% above background at 30 keV, and extends at least to 120 keV. This spectrum is less steep than that of the Scorpius source and cannot be fit with a simple characteristic temperature. The Scorpius flux is about $0.35 \text{ photons/cm}^2\text{-sec}$ over the 18 to 50 keV range; that of the Crab is 0.25