accuracy is proportional to $s = (2r - 1) \log_{10}(t)$, where r is the number of variables affecting the energy of the orbit.

Balmer Line Emission from a Shell. STUART R. POTTSCH, *Princeton University Observatory*.—We have attempted to determine the Balmer line ratio $H\alpha:H\beta$ from a consideration of the equations of statistical equilibrium for a shell of hydrogen gas at a constant electron and temperature. This present work differs from that of Menzel and associates in the three following respects:

(1) A wide range of electron densities is considered, from 10^7 cm^{-3} to 10^{13} cm^{-3} (although this value is kept constant in a given atmosphere). This requires that collisional transitions between levels be included.

(2) Radiation in the Balmer and Paschen continua impinging on the atmospheres is included, although the atmospheres are always assumed thin enough so that these radiations remain roughly constant through an atmosphere.

(3) The atmospheres considered have varying opacities to $H\alpha$ radiation (from completely thin to completely thick) and so it is necessary to consider the transfer of the Balmer line radiation. Since we assume a four-level atom plus continuum, it is necessary to solve simultaneously the transfer equations for $H\alpha$ and $H\beta$. The principal effort of this work is so directed.

21-cm Maser Observations of Galaxies. MORTON S. ROBERTS, *Harvard College Observatory, Cambridge, Massachusetts*.—A three-level solid-state maser, designed for operation in the vicinity of 1420 Mc, and located at the focus of the George R. Agassiz 60-foot radio telescope was employed for these observations. The estimated system noise is 100°K . For comparable bandwidth and time constant this system is thus significantly more sensitive than the conventional radiometers now in use. A Dicke mode of operation was employed; comparison was with a resistor immersed in liquid helium. All observations were made with a multichannel recorder. Five of the six channels available employed 150 kc filters.

Results for 5 Sc galaxies studied in the first phase of an over-all galaxy program are given below. An important datum resulting from such a study is the ratio $g = \mathfrak{M}_{H\alpha}/\mathfrak{M}_{\text{total}}$. For small values of opacity ($\tau < 1$) this ratio may be expressed in terms of radio and optically determined quantities by the following equation:

$$\log g = \log A + 0.4m_{\text{pg}} - \log f + C.$$

Here A is the total hydrogen-line radiation (assuming no interaction with continuum), m_{pg} is the

photographic magnitude corrected for obscuration and tilt, f is the mass to luminosity ratio, and C is a constant including atomic parameters, calibration values, etc.

As a first step, we may avoid evaluating f and only assume that it is constant for Sc-type galaxies. Ratios of g with respect to any particular galaxy may then be determined; NGC 2403 was chosen as the reference. Values for g/g_{2403} determined in this manner are: NGC 628, 1.2; NGC 2403, 1.0; NGC 4244, 1.1. These values are very likely correct to within 20% if the assumptions made above are valid. For a value of $f=5$, g is approximately 0.1 for the above galaxies.

The 21-cm velocity profile for IC 10 was also obtained. This galaxy has a very low galactic latitude and is unusual in appearance. For these reasons m_{pg} and f and therefore g are difficult to evaluate. NGC 2903 was detected as a continuum source only. If its mass to luminosity ratio is similar to that for the above galaxies then $g_{2903}/g_{2403} < 0.3$.

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Observations of a Plane-Polarized Component in the Cosmic Background Radiation of 408 Mc.

C. L. SEEGER and G. WESTERHOUT, *Stanford Radio Astronomy Institute, and The Leiden Observatory and the Netherlands Foundation for Radio Astronomy*.—Exploratory observations, using a 408-Mc phase-switch polarimeter installed in the Dwingeloo 25-m mirror, have detected a plane-polarized component in the general nonthermal background radiation. The observations cover sample regions above, in and below the galactic plane and along the spur at $l^{\text{II}}=0$. Most observations were repeated on different nights and at different hour angles. Extensive measurements were made to determine and minimize spurious effects. The cross-polarized side lobes were mapped and cannot have influenced the results appreciably. An instrumental polarization of about 3°K was derived from all-night observations of the north pole, and the observations were corrected for this effect.

The observations suggest that either the interstellar magnetic field is constant in direction over large parts of the Galaxy, and the electron density near the plane rather less than expected, or that the observed polarized radiation originates relatively near the sun. The direction of the polarization is relatively constant along the spur. This direction is roughly orthogonal to the direction of the polarization along the galactic plane. Interpretation is difficult due to the lack of information on the electron component of the cosmic rays. But even now one can say that a general mapping program of the magnetic fields of the Galaxy is possible with present-day techniques.