is seen that the ions of high ionization potential are moving toward us faster than the ions of low ionization potential, and if we exclude hydrogen, the velocity-ionization potential relation is roughly linear. The difference in velocity between the ion of highest ionization potential (Ne^+) and lowest (Fe^+) is about -13 km sec^{-1} . If we assume that we observe only the near side of the nebula, and that the level of ionization increases as we proceed inward toward the center, this result implies that the interior portion of the nebula is expanding faster than the outer portion. This increase in radial velocity as we move inward toward the center of the nebula was first pointed out by Wilson, Münch, Flather, and Coffeen (*Astrophys. J. Suppl.* 4, 199, 1959). The correction of the observed radial velocities to the sun was kindly supplied by Dr. Bowen. The corrected radial velocities are in good agreement with those given by the above authors.

The Spectrum of the Radio Source 1934-63.

KENNETH I. KELLERMANN, *CSIRO Radiophysics Laboratory* (present address National Radio Astronomical Observatory).—Observations of the radio source 1934-63 have been made at a large number of frequencies between 350 and 5000 Mc/sec using the CSIRO 210-ft radio telescope. The spectrum is found to be broadly peaked near 1400 Mc/sec. At higher frequencies, the spectral index is approximately -1.2 while below 1400 Mc/sec the flux density rapidly decreases with decreasing frequency.

The form of the spectrum may be explained as synchrotron radiation from relativistic electrons having an energy distribution of the form $N(E) = KE^{-3.4}$ and where there is either (a) absorption due to free-free transitions in an ionized hydrogen region having an emission measure of about $10^6 \text{ cm}^{-5}\text{-pc}$ and an electron temperature of $10^4 \text{ }^\circ\text{K}$; or (b) self-absorption by the relativistic electrons. Assuming a magnetic field of 10^{-4} G , the angular size of the source must then be about $0''.0015$, the linear dimensions $\lesssim 15 \text{ pc}$, the surface brightness about $10^{13} \text{ }^\circ\text{K}$, and the density of relativistic electrons about 10^7 cm^{-3} . A normal power law spectrum can also be modified at low frequencies if the synchrotron emission occurs in a region where the index of refraction is less than unity. A density of $4 \times 10^3 \text{ electrons cm}^{-3}$ is needed to produce the observed cutoff at 1400 Mc/sec.

The possibility that the source may be an artificial transmission from an intelligent civilization is also discussed.

Measurements of the flux density below 200 Mc/sec are needed to discriminate between the various models proposed to explain the spectral distribution.

Lunar Surface Particle Size from the Polarization of Lunar Light. C. E. KENKNIGHT, *Litton Systems, Inc.*—The polarization of light scattered from a powder surface increases with particle size and with decrease in surface reflectivity. These two variables are not independent but are related through the transparency of the particles. Calibration of the polarization of the scattered light as an indicator of particle size was obtained for green light by optical measurements on various sifted rock powders of graded sizes. The samples were bombarded by a simulated solar wind to vary the sample albedo. The photometric function for particles less than 75μ in diameter was in good agreement with lunar measurements when the sample albedo was reduced to lunar values. Either of two indices of the polarization may be combined with albedo data to infer that most of the lunar surface particles are less than 50μ (100μ) in diameter if opaque (translucent) before solar wind bombardment.

A Radio Survey of Clusters of Galaxies. H. C. Ko, *Ohio State University Radio Observatory*.—The Ohio State University 260-ft radio telescope has been used to conduct a survey of radio emission from clusters of galaxies and their surrounding regions. Beamwidths are 10 min of arc in right ascension by 38 min of arc in declination at 1415 Mc/sec.

The observational results of the well-known nearby clusters of galaxies (Coma, Perseus, Virgo and Pegasus clusters) and some distant clusters are discussed. Radio spectra of the component radio sources in the clusters have been assembled.

From a study of the results of the present observation and the existing published data by others, the following conclusions are obtained: (1) radio emission from a cluster of galaxies is always dominated by emission from one or more peculiar radio galaxies in the cluster, (2) there are very few clusters of galaxies in which more than one member galaxy has been identified with a radio source (Perseus Cluster, and Virgo Cluster), (3) clusters in which more than one radio source has been found are very few (Coma, Perseus, Virgo, Pegasus, A119) and (4) the individual spectra of the component radio sources in a cluster differ significantly.

On the Rotation of Spectroscopically Invisible Binary Components. ROBERT H. KOCH, *Amherst College Observatory*.—Kruszewski (*Acta Astron.* 14, 231, 1964) has recently studied particle trajectories arising from and returning to the chromosphere of a close binary component. These trajectories differ from most of those previously investigated in that the component star with which