edge. Two of the intermediate tails reached to within 0.2 a.u. of the earth, and formed the broad diffuse features in the photographs.

The positions of the observed tails agree well with computed positions of particles ejected from the nucleus, and several conclusions can be drawn. Each tail, except the gaseous part of the ordinary tail, was a synchrone composed of dust ejected from the nucleus in a period of perhaps a few hours. The dust in the spike was ejected about 18 March; this dust was closely concentrated to the orbital plane on 25–26 April, when the spike was narrowest because it had been ejected almost exactly 180° earlier in the comet's orbit. Six other synchrones were ejected in March and April, with maximum speeds of ejection normal to the orbital plane of 400 to 600 m/sec. Dust driven from the nucleus by evaporating gas (as in Whipple's icy comet model) would have the same sort of speeds and would generate tails having the same sort of outline and photometric cross section as was observed.

Rough photometry of the photographs yields the relative abundances of dust particles of different sizes. The size distribution varies from one tail to another, suggesting differences of composition between different layers of the icy nucleus. Most of the total particle mass is in the larger particles observed (radius $\times$ density $\sim 10^{-2}$ g cm $^{-2}$). Together with meteor data, this suggests that most of the total mass of solid particles leaving comets is in particles of that size, or one or two powers of ten larger.

Measurements of the Sun, Moon, Venus, and Tau A at 1.18 cm Wavelength. D. H. STAELIN, A. H. BARRETT, AND B. R. KUSSE, *MIT*.—During December 1962 observations were made of the sun, moon, Venus, and Tau A at 1.18-cm wavelength ($f=25.5$ Gc/sec). A 6.0 min beamwidth was obtained using the 28-ft-diameter paraboloid reflector at Lincoln Laboratory, MIT. The radiometer was a Dicke-type superheterodyne with a bandwidth of 8 Mc/sec and a sensitivity of 2.5°K with a 5-sec integration time.

Lynn, Meeks, and Sohigian of Lincoln Laboratory made simultaneous observations at 8.5 mm (35.2 Gc/sec) using the same antenna feed horn and noise tube calibration.

Venus was observed by taking 94 drift curves and 42 on-off measurements. The on-off data yielded an average brightness temperature of $400(+75, -55)^\circ\text{K}$, and the drift curve data yielded $390(+75, -55)^\circ\text{K}$. Twenty drift curves of Taurus A give a flux density of $275 \pm 85 \times 10^{-26}$ W m $^{-2}$ cps $^{-1}$, assuming a disk of uniform brightness 3.6 min in diameter. The brightness temperature of the sun

was determined to be $8870 \pm 980^\circ\text{K}$, and the observations of the moon yielded brightness temperatures for the center of the moon of $240 \pm 40^\circ\text{K}$ 3.5 days before full moon, $254 \pm 30^\circ\text{K}$ 0.3 days before full moon, and $254 \pm 30^\circ\text{K}$ 1.8 days after full moon.

Typical zenith attenuation encountered was 0.2 dB, as determined by observations of the sun and the sky brightness temperature. The antenna gain of $64.6 \pm .5$ dB was determined by scaling the gain measured at 35.2 Gc/sec and checked by measurements of the beam shape, sidelobe level, and magnitude as determined from the solar and lunar data. The gain was 64.6 ± 0.5 dB.

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Intergalactic Magnetic Field and Galaxy Formation. NOEL STONE AND MARVIN L. WHITE, *CRZIP, L. G. Hanscom Field*.—It is demonstrated theoretically that a primordial intergalactic magnetic field is responsible for the production of galactic rotation and a magnetic tidal bulge which is responsible for the elongation of galaxies. Eventually a second magnetic field, i.e., a self-induced dynamo field is set up, the current systems being identified with the galactic arms. The latter, by Ampere's law, are encompassed by a toroidal magnetic field. The latter became helical when combined with the longitudinal field originating from the intergalactic field. Such fields have been detected in our galaxy by Ireland. Currents flowing from the galactic center, along the spiral arms are gradually used up by star formation processes. Once the plasma disappears, the spiral arms collapse, and the spiral evolves into an elliptical galaxy. However, the plasma can be replenished by neutral gases which are uninhibited by the dynamo magnetic field, being drawn gravitationally into the galactic center to form the lens.

The theory can account for the curvature of the spiral arms and the observed angular velocity profile.

Equilibrium of Ba II in the Solar Atmosphere. E. TANDBERG-HANSEN, *High Altitude Observatory*.—The lines of Ba II, multiplets Nos. 1 and 2, have been studied on the 1952 eclipse plates. We find that the resonance lines (4554 and 4934 Å) are significantly affected by self-absorption below about 1500 km in the chromosphere. The faintest line of multiplet No. 2 seems free from self-absorption and gives an emission gradient of 4.6×10^{-3} cm $^{-1}$ or a scale height of 215 km.