Greatest separation of the order of $0''.5$ will occur in 1965. Visual observations of the separation and magnitude of the companion would lead to the first direct determination of the mass of an A star above the main sequence.

Recent Experiments with Image Tubes at Kitt Peak National Observatory. WILLIAM LIVINGSTON AND C. R. LYNDS, *Kitt Peak National Observatory*.—The image orthicon television-camera tube has been tested as the light receiver for a fast nebular spectrograph on the 36-inch telescope. Observations of astronomical objects, with exposure times of up to 90 min, demonstrate the ability of the system to record faint emission features which could not be reached by photographic methods on this telescope. However, various effects that are peculiar to the image orthicon such as beam bending and low latitude, seriously limit the quantitative aspects of the spectra.

More encouraging results have been obtained with a high-gain imaging photomultiplier (English Electric Valve P829) which permits the certain recording of individual photoelectrons. A pulse counting field photometer utilizing this type of tube is being developed. At the 60-inch solar telescope the imaging photomultiplier has been used for high-dispersion work on the planets and bright stars.

Evidence for an Explosion in the Center of the Galaxy M82. C. R. LYNDS, *Kitt Peak National Observatory* AND A. R. SANDAGE, *Mt. Wilson and Palomar Observatories*.—New observations in optical frequencies of the peculiar optical and radio galaxy M82 reveal a massive system of filaments which extends along the minor axis to a height of 3000 pc above and below the fundamental plane. Emission lines typical of low-excitation gaseous nebulae are present. The filaments on both sides of the plane appear to be expanding from the center along the minor axis with velocities ranging up to about 1000 km/sec. The data suggest that an expulsion of matter took place from the central regions of M82 about 1.5×10^6 yr ago. The $H\alpha$ emission flux from the filaments is estimated to be 1.7×10^{-11} erg cm $^{-2}$ sec $^{-1}$ at the earth's surface, which requires a total emitted power of 2×10^{40} erg sec $^{-1}$ in $H\alpha$ if the distance modulus of M82 is $m - M = 27.5$. The ion density in the filaments, estimated from the volume emissivity, is 10 protons cm $^{-3}$, which then requires that the visible mass of the expanding material is $5.6 \times 10^6 M_{\odot}$ as an upper limit. An upper limit to

the kinetic energy of the visible filaments is 2.4×10^{55} ergs.

The filaments form fragments of loops and appear to outline lines of magnetic force. Parts of the filaments appear to radiate weakly in the continuum as well as in the emission lines, and this suggests that optical synchrotron radiation may be present. Polarization measurements of part of the filamentary structure by Elvius and Hall seem to be consistent with this possibility. The radio flux data are combined with an estimate of the optical synchrotron flux, and a theoretical power spectrum is computed. The rate of synchrotron radiation is 2×10^{42} erg sec $^{-1}$ which amounts to 9×10^{55} ergs over the lifetime of 1.5×10^6 yr if the power level has been constant over this time interval.

Calculation shows that the source of excitation for the observed low-energy recombination spectrum may be the optical synchrotron radiation field which extends to frequencies above the Lyman limit.

8.5-Millimeter Radio Emission from Venus and Taurus A. V. L. LYNN, M. L. MEEKS, AND M. D. SOHIGIAN, *Lincoln Laboratory, MIT*.—A precisely calibrated 28-ft antenna, operating at a wavelength of 8.5-mm with a beamwidth of 4.3 min, has been utilized to observe emission from Venus near inferior conjunction and from the source Taurus A. Simultaneous observations at 12 mm with the same antenna are described in a companion paper. The instrumentation and observational techniques are described.

The brightness temperature of Venus, observed approximately one month after inferior conjunction during the passage of the radiometric probe, Mariner II, was found to be $380^{\circ} \pm 55^{\circ}$ K, in close agreement with previously reported results.

Observations of Taurus A in the millimeter band have been previously reported only by Kuz'min and Salomonovich (Kuz'min, A. D. and Salomonovich, A. Ye., *Dokl. Akad. Nauk SSSR* **140**, 81, 1961) at 8 mm. They observed the presence of a second source 36 sec east of Taurus A. Some evidence was found to support the existence of this second source but the results are inconclusive.

Taurus A was found to have a width of $3.0' \pm 1.0'$ in right ascension. Based on a width of 3.6, consistent with previous determinations, and assuming a Gaussian distribution of brightness, the flux density is found to be $(300 \pm 45) \times 10^{-26}$ W m $^{-2}$ cps $^{-1}$. The corresponding brightness temperature is $12^{\circ} \pm 2^{\circ}$ K.

The mean central brightness temperature of the moon was found to be $254^{\circ} \pm 20^{\circ}$ K.