means of the $H\alpha$ and $[NII]$ emission lines. The rotation curve for the bar and points outside is shown. A preliminary estimate of the mass of the bar is given, and some ideas concerning the structure of barred spirals are discussed.

Heat Transfer Coefficient for Meteors Shielded by an Air Cap. ALLAN F. COOK, *Harvard College Observatory*.—The equation of heat conduction is solved for the following model: The presentation area of the meteoroid is a flat circular surface normal to the direction of flight. Only rotational and translational degrees of freedom are activated within the air cap. Vibrational and electronic degrees of freedom are assumed to require much longer times for activation than the average duration of the transit of an air molecule through the air cap. The boundary conditions are the surface temperature at the meteoroid and at the front of the air cap, those obtaining immediately behind a shock wave traveling at the velocity of the meteoroid. Isobaric conditions are assumed within the air cap. The equation of continuity is also employed. The results indicate heat transfer coefficients ranging from $\frac{1}{3}$ at a velocity of 12 km/sec⁻¹ to 1/20 at a velocity of 72 km/sec⁻¹ provided the meteoroid is larger than a mean free path of a high velocity air molecule in the air. These values are increased by about 40% for a turbulent boundary layer.

Narrow Band Photoelectric Photometry for G and K Giants. D. L. CRAWFORD, *Kitt Peak National Observatory*.—Narrow band photoelectric photometry has been done on a number of G and K giant stars. The three filters used measured the break in the spectrum at the G band and at a CN band. The range in each parameter is about 0.300 mag. and the mean error of one observation is ± 0.007 . A good correlation with spectral type, luminosity, age or space velocity, and line strength is shown. In addition, *UBV* colors are available for a few of these stars and these colors strengthen the correlation. Peculiar CN stars stand out clearly.

The Structure of Sunspot Penumbrae. ROBERT E. DANIELSON, *Princeton University Observatory*.—Many sunspot photographs having a resolution of about $\frac{1}{3}$ second of arc were obtained last summer during Project Stratoscope. These photographs show the penumbra resolved into a complex array of predominantly radial filaments. Most of these filaments have an apparent width of about 300 km

(which is the diffraction width of the 12-inch telescope) and a length of 5000 to 10 000 km (the width of an average penumbra). Thus it is possible that the filaments have an actual width smaller than 300 km.

The filaments are, for the most part, brighter than the umbra, but not as bright as the granulation. Many of the filaments are recognizable after 10 minutes even though noticeable changes can occur in a few minutes. A few filaments have been traced for 40 minutes. Thus their lifetime is definitely longer than the lifetime of the granulation.

The filaments cannot be explained as hot material flowing up at the inner edge of the penumbra in tubes of 300 km diameter (or less) and flowing across the penumbra along magnetic lines of force. The reason is that the time for cooling by radiation of a 300-km filament is of the order of 1 minute while the time for material to flow across the penumbra (Evershed effect) is of the order of 100 minutes. Because of this short cooling time, the only macroscopic flow which is capable of explaining the filaments is convective rolls with the axis of the roll along the magnetic field. It is thought that most of the penumbral filaments can be explained in this fashion. Some filaments, however, are seen to cross other filaments while some are observed in places where they cannot be convective rolls. These filaments must therefore lie above the surface of the sunspot and are therefore structures in the chromosphere above the sunspot.

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A Report on Experiments with the Image Orthicon As a Light Receiver. JOHN H. DEWITT, JR., *Dyer Observatory, Vanderbilt University*.—Work was begun in May, 1956 on the "Mars" project which was designed to explore the possibility of using the television image orthicon tube, then available, as a light receiver at the output of a telescope for the indirect photography of planetary images. A system was developed using an electronic image stabilizing device which overcame some of the deleterious effects of atmospheric instability.

When the General Electric Z-5294 orthicon utilizing a magnesium oxide target became available in the fall of 1958 it was apparent that its superior storage characteristics would permit photography of very faint objects and possibly show a large improvement over the sensitivity of the photographic plate. Subsequent trials at the output of the 24-inch Cassegrain telescope indicated that eleventh magnitude could be reached in 1/30th sec and fifteenth magnitude in 8 sec or less. Equipment now being designed and constructed to explore further possi-