titanium oxide, and the effects of temperature on its spectrum, should show whether either of these two possibilities satisfies the necessary conditions.

The star α Tauri, of Class K4, was also measured. It shows the more conspicuous of the titanium oxide bands, and would appear to be classified much too early as judged by the summed intensities of these bands. This indicates that possibly while the band classification evidently forms a sequence similar to the one defined by line intensities, the sequences may overlap. As the Ca/Ca+ ratio has evidently a turning point in the K stars, a possible overlapping could not be definitely detected by means of this ratio.

NOTE ON SILICON AND STRONTIUM STARS IN CLASS A OF HARVARD CATALOGUE.

By C. Hujer.

The Henry Draper Catalogue contains about 200 stars marked as peculiar, mostly belonging to spectral class A. "Silicon stars" are characterized by the lines λλ4128, 4131, of ionized silicon, and "Strontium stars", by the lines λλ4078, 4215 of ionized strontium. Unusually high intensities of the Si and Sr lines were supposed to be closely correlated.

At the suggestion of Professor E. B. Frost these stars were examined throughout class A and the later subdivisions of type B. All the spectrograms of these types down to apparent magnitude 5.5, taken at Yerkes Observatory with the Bruce spectrograph of the 40-inch refractor were analyzed for this purpose on the Hartmann spectrocomparator. I have examined the best spectrograms of about 350 stars of classes A and B. The intensities of Si 4128, 4131, Sr 4078, 4215, and Mg 4481 were estimated on an arbitrary scale. The intensity of the silicon line 4128 in 49b Cancri was called 10. Complete absence of the line was designated by 0. The method of estimates closely agrees with that used by Dr. Struve in his study of detached calcium lines. The Yerkes slit-spectrograms, with their high dispersion, have permitted an accurate spectral classification, based on the intensities of the metallic lines, by a method similar to that suggested by Adams and Joy (*Ap. J.*, **56**, 243). The [H] and [K] lines, which form the basis of the Harvard classification could not be used as they lie too far from the region of best definition of the Yerkes spectrograms. Distinct differences from the Harvard classification were noted in a good many cases. The character of the lines is indicated by the letters s (sharp) and n (nebulous).

The relation between the silicon lines and the strontium lines is not quite so definite as had been supposed. The most intense silicon lines were found in the types from A0 to A3, in agreement with a statement of Miss Payne in her book on *Stellar Atmospheres*. Some stars, such

as 21 Persei, of type A1s, or 43 Cassiopeiae, of type A0n, show both the silicon and strontium lines of about equal, moderate, intensity, while other stars, like 17 Aurigae, of type A0s, and 36 τ^9 Eridani, of type A1s, which have silicon lines of nearly maximum intensity, scarcely show any trace of the strontium lines. Yet not one star with unusually strong strontium lines was found in the early A types with the silicon lines absent. The occurrence of the strong silicon lines λλ4128, 4131 in the early A-type stars appears to be a definitely abnormal phenomenon, and these so-called "silicon stars" can hardly be included within the normal class-A sequence.

These stars are scattered all along the galaxy and do not form separate, localized groups.

INTERFEROMETER MEASUREMENTS OF WAVE-LENGTHS IN THE VACUUM-ARC SPECTRA OF TITANIUM AND OTHER ELEMENTS.

By C. C. Kiess.

Titanium lines are present in the spectra of the sun and stars and the titanium spectrum is used as a standard reference spectrum. Considerable work has been done in determining the wave-lengths of iron with high precision, but the spectrum of titanium has been comparatively neglected. Previous interferometer measures on titanium cover only a portion of the region of astrophysical importance; the present work applies to more than one octave of the spectrum, and gives standard wave-lengths for about 300 vacuum-arc lines from 2941A, in the ultraviolet, to 6743A, in the red. For many of these lines the accuracy of measurement exceeds one part in 6,000,000, and for the majority it exceeds one part in 4,500,000. From the known series relationships of the lines, it has been possible to compute the terms involved in their production, using for this purpose only the wave-numbers of lines measured in the vicinity of the neon standards, and the constant term separations as determined in various parts of the spectrum. From these terms the wave-lengths of the blue and violet lines have been calculated, and their agreement with the observed values shows that no difference in scale exists between the red and violet regions. In addition to titanium, some wave-lengths of iron, copper, calcium, barium and other elements were also measured.

RECENT RADIOMETRIC OBSERVATIONS OF THE PLANETS.

By C. O. Lampland.

With a large radiometer of special type, constructed for measurements on the moon, all points of the lunar surface may be readily observed with the compensated type of thermocouples. Seven transmission