in the constellation *Libra,* and during the two months will move about 12° eastward and southward.

Saturn on September 1 is still an evening star, but the Sun is rapidly drawing nearer to it so that conjunction is reached on October 17 and the planet becomes a morning star. By the end of October the planet will rise about an hour before sunrise, and may possibly be seen if weather conditions are good. During the two months the planet moves about 7° eastward and southward in the constellation *Virgo.*

Uranus reaches opposition with the Sun on the night of September 8, and is then above the horizon the whole night. At the end of October it sets about 2 A. M. During the two months it moves about 2° westward and southward away from the fourth magnitude star ϕ *Aquarii* which is a fraction of one degree east and south of the planet on September 1.

Neptune passed conjunction with the Sun on August 1 and is now a morning star. It moves about 1°.5 eastward into the extreme western part of *Leo* during the two months.

NOTES FROM PACIFIC COAST OBSERVATORIES

Search for Intramercurial Bodies

The extensive search for intramercurial bodies made by Dr. C. D. Perrine[1] at the three total solar eclipses of 1901, 1905 and 1908 led to a negative result and left little probability that such bodies exist unless they are small and faint. In the meantime also the problem of the motion of the perihelion of *Mercury* which had been the starting point for the search of an intramercurial planet, changed its aspect. Seeliger's[2] hypothesis on the structure of the Zodiacal Light and more recently Einstein's[3] Generalized Theory of Relativity offer explanations which make the assumption of one or several perturbing planets inside of *Mercury's* orbit unnecessary. Although these developments may have reduced its importance, the question, whether there are any small planets closer to the Sun than

[1]*Lick Obs. Bull.,* **1,** 183, 1902; **4,** 115, 1906; **5,** 7, 1908; **5,** 95, 1909.
[2]*Sitzungsber der mathem.—phys. Klasse der Kgl. Bayer. Akad. der Wissensch,* **36,** ......, 1906.
[3]*Annalen der Physik,* **49,** 769, 1916.

Mercury, has an interest of its own; and it is desirable to extend the search for such bodies to the utmost limit of our instrumental means.

The photographs obtained by the Wm. H. Crocker expedition during the total solar eclipse of September 21, 1922, at Wallal, Western Australia, for the purpose of measuring the light deflection predicted by Einstein's theory, show somewhat fainter stars than had been photographed before during solar eclipses. A careful search was therefore made by Mr. Trumpler on one of the plates taken by Mr. Campbell with the smaller Einstein cameras (4 inches aperture, 5 feet focal length). The plate used, 17x17 inches, with Seed 23 emulsion, had an exposure of 1 minute made at the middle of the eclipse, the telescope being guided so as to follow the stars. The faintest star images are of the photographic magnitude 10.2 and about 550 stars are visible. The field of the plate over which the search was extended is 15°x15° with the eclipsed Sun in the center. According to Chapman and Melotte[4] an area of 225 square degrees at the galactic latitude of our region should contain in the average 830 stars brighter than the photographic magnitude 10.0. Although the difference is well explained if our field is poorer in stars than the average, it is possible that the search is not complete between the magnitudes 9.5 and 10.2, especially within the limits of the corona and near the corners of the plate where the star images are somewhat less sharp.

Two of the eclipse photographs as well as one of the comparison photographs of this area of the sky secured at Tahiti in May, 1922, with the same instrument were placed in the measuring engine one on top of the other. One of the eclipse plates (N19) was then searched with the microscope magnifying 15 times and any object resembling a star image or star trail was looked up on the other two plates by simply changing the focus setting of the microscope. Spots were thus easily eliminated and the fixed stars were identified by their presence on the Tahiti plate. In a few doubtful cases some of the other eclipse plates were also examined. Any planet or comet in the neighborhood of the Sun should be visible on all the eclipse

[4]*Memoirs, R. A. S.,* **60,** 157, 1915.

photographs but not on the Tahiti plates. No such object was found.

The observer is under the impression that a planet brighter than the photographic magnitude 9.5 within the field of the plate could hardly have escaped detection unless it was situated in the denser part of the corona or had a sensible apparent motion during the one minute exposure. For a planet revolving around the Sun at half the distance of *Mercury* the maximum apparent motion would be only 7″ per minute; even in this unfavorable case the resulting short trail for an object brighter than magnitude 8.5 should have been well visible.

In comparison with Perrine's search of 1908 it may be stated that Perrine's field, 8¼° wide and 25° long parallel to the Sun's equator was of nearly the same size but of a more favorable shape. The 1922 plates of the five-foot cameras, however, reach stars at least half a magnitude fainter and are also more effective in the case of sensible apparent motion on account of the shorter exposure (1 minute as compared with 3 minutes in 1908) and the smaller focal length (5 feet as compared with 11 feet 4 inches in 1908).

W. W. CAMPBELL.
R. TRUMPLER.

NOTE ON THE VACUUM SPARK SPECTRA OF METALS

The vacuum spark spectrum of silicon has been studied by Sawyer and Paton,[1] and Schallenberger[2] has announced some results for aluminum obtained by the same method.

By means of a very heavy condensed spark in vacuum the writer has recently obtained some interesting spectrograms, using terminals of calcium, lead, magnesium, brass, aluminum and carbon. All of these show many new lines; for example, the spectrum of calcium has about 1000 lines between the limits $\lambda\lambda$ 2100 and 6500, of which not more than 75 can be identified as known lines of calcium or other elements. Not all of the known arc and spark lines are present, which suggests that the normal state of the atom in this source is one in which it has

[1] *Phys. Rev.*, **19**, 256, 1922.
[2] *Phys. Rev.*, **19**, 398, 1922.