plates. We have measured other bands as follows:

Extending from about λ 4290 to λ 4250 with center at λ 4267.

Extending from λ 4030 to λ 3995 with center at about λ 4015.

Center at about λ 3915, less refrangible edge at about λ 3920.

Center at about λ 3795.

Those at λ 4267 and λ 3920 fall in the position of the only lines (as contrasted with bands) in the carbon spectrum in this region, but we do not regard this as an identification.

The tail extends out in very different intensities from some of the knots: thus λ 4737 has only a small extent of tail, but the knots at λ 4737 and 3883 give the appearance of a greater development than the others in the direction away from the tail, *i. e.,* toward the front of the head.

Otherwise the spectral images of the tail exhibit the same general structure shown by direct photographs of the comet on the same nights. No marked changes in the chemical constitution of the tail have been observed by us between October 28 and December 1. It is interesting to note, however, that this simple apparatus would have been competent to show any differences in constitution such as called for by Bredichin's theory, had it been used on September 16, when the direction of the tail changed through a large angle from its direction before and after that date.

A detailed account of our study of these plates, with reproductions of some of them, will appear later in the *Astrophysical Journal.*

EDWIN B. FROST,
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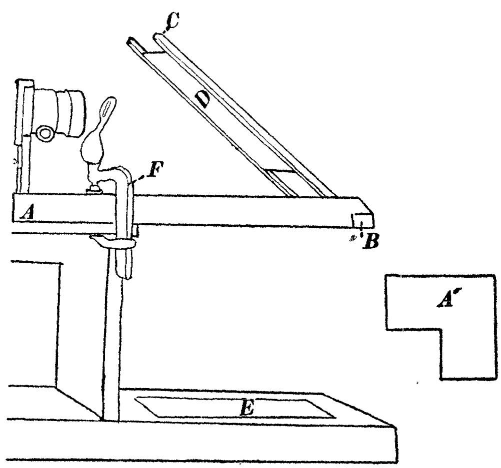
YERKES OBSERVATORY,
December 2, 1908

A SIMPLIFIED APPARATUS FOR DRAWING WITH THE AID OF THE PROJECTION MICROSCOPE

IN a number of laboratories there are in use devices for drawing by the aid of a projection lantern. These vary in complexity from a simple easel at which is traced the direct projection of the image, to comfortable dark rooms especially equipped for this work and with an apparatus for reflecting the image to the table at which the artist sits. The first type is inconvenient and fatiguing, the second, on account of both the expense and the space demanded, is not available in every laboratory. It was Professor S. H. Gage's complete and excellent equipment that suggested the here-described simple device, to be used in the lecture-room where the projection outfit stands, without duplication of apparatus or requirement of extra space.

It consists merely of a rod holding a mirror at an angle of exactly 45°, clamped to the stand which carries the projection lantern or the microprojection outfit. With this in use one may sit at a table in a darkened room and trace the projection of microscopic preparations, lantern-slides or of photographic negatives. A glance at the diagram will show the extreme simplicity of the parts involved.



A, shown also in end-section at *A',* is a piece of wood two by two inches and about three feet long, grooved by means of a rabbet plane so as to clamp firmly to the lantern table (see *A'*). The arm *B* bears the two grooved strips *C* which carry at an angle of 45° the mirror *D.* This casts the image on the drawing surface *E,* where it may be traced with ease.

The magnification depends directly upon the distance of the drawing board from the mirror. Thus if the enlargement is two times when line *E–D* is ten inches, the image will be enlarged four times if line *E–D* is twenty inches.

Magnification also depends, of course, upon the distance of mirror from the lens.

The apparatus has been especially helpful in making rapidly, and to scale, accurate drawings of insect wings, mouth-parts and the like. One student, who was also working in vertebrate zoology, found it of the greatest service in making from negatives enlarged drawings of the arrangement and distribution of the scales of various reptiles. But in addition to this outline work it is also perfectly feasible to use it with more detailed drawings from microscopic preparations if the room be well darkened. It is quite possible that a similar device has long been in use by others, but I have failed to find any mention of it and I have, therefore, thought that this description might be of aid to some.

Wm. A. Riley

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 655th meeting was held November 21, 1908, President Bauer in the chair. Three papers were read at this meeting, as follows:

The Radiation Laws of Metals: W. W. Coblentz.

A knowledge of the laws governing the radiation of metals with variation in temperature is of interest in connection with the numerous speculations offered to explain the great light emissivity, *i. e.*, the high luminous efficiency of the new incandescent lamps with metal filaments.

The speaker described some results obtained in an investigation of the most important so-called constant, α, of the type which obtains for a "black body" in which $\alpha - 1 = 4$, in Stefan's law of total radiation. The substances examined were tungsten, tantalum, osmium, platinum and several types of carbon filaments, usually in the form of 110-volt incandescent lamps. The spectral distribution of energy was measured with a bolometer.

It was found that the so-called constant, α, decreased with rise in temperature, and in all cases higher in value than that of platinum.

It seems to be a physical property of metals to have a low reflecting power in the visible, and especially in the ultra-violet, part of the spectrum. Throughout the infra-red the reflecting power of metals is uniformly high. The low reflecting power in the visible spectrum causes an abnormally high emission in this region, which, in connection with the high values of the so-called constant, α, accounts for the high luminous efficiency.

Although it seems to have been overlooked heretofore, it is obvious that the so-called constant, α, must decrease in value and approach that of a "black body," otherwise a point would be attainable at which the radiation is greater than that of a black body at the same temperature.

From the results obtained it is evident that the spectral emissivity function of metals must be far more complex than that given in the Wien equation. Since the emissivity is a function of the reflecting power, which is a function of the refractive index and of the absorptive coefficient, which, in turn, are functions of the temperature, the wave-length and the electrical conductivity, it is evident that the spectral emissivity equations must contain factors which will take account of these phenomena.

Determination of Flexure of Pendulum Supports by the Interferometer: W. H. Burger.

In measuring the force of gravity by means of a swinging pendulum, the observations are necessarily made under varying conditions, and the period of vibration of the pendulum is consequently affected by many causes, and corrections have to be applied before the value of g can be ascertained. One of the important corrections results from the elastic yielding of the pendulum support. Several methods have been used to measure the flexure of the pendulum support and to ascertain its effect upon the period of the oscillating pendulum. Each of these methods contains some doubtful assumptions, and to avoid which the new plan of employing the interferometer for measuring the absolute displacement due to flexure of pendulum support was devised by Messrs. Hayford and Fischer, of the Coast and Geodetic Survey. The instrument used is a modified form of the Michelson interferometer. In observing, the instrument is separated into two parts, the main body of the instrument, and the mirror attached to the pendulum case, each being carried on entirely separate supports.

The experiments carried out by the speaker included tests of flexure of both pendulum case and of the pier upon which the case was mounted. The displacements were found to be movements of rotation. For comparison the static force method was also used in the experiments. Measurements of displacement were made with the pendulum case mounted with various substances between the