OPTICS – *Experimental verification of the principle of Doppler-Fizeau.* Note by MM. **CH. FABRY** and **H. BUISSON,** presented by M. P. Villard.

The principle of Doppler-Fizeau has for a long time been verified by astronomical observations. Laboratory verification is made difficult by the smallness of the realizable speeds; however, the very delicate experiments of Belopolsky (1) and Galitzine and Wilip (2) revealed the existence of the phenomenon and measurement of its magnitude by using many reflections on mobile mirrors.

With the means currently available, we can demonstrate and measure the phenomenon of Doppler-Fizeau by an enough simple experiments to constitute a handling by a student. Here is how we carried out this experiment.

The mobile object is a horizontal blank paper disc, of 16cm of diameter, set in fast rotation around its axis; it is mounted on the axis of a centrifugal separator, small apparatus whose crank is driven with the hand, and who gives to the disc a number of revolutions of approximately 200 turns a second. The points on the edge of the disc move thus with a speed of 100m a second. The disc is illuminated by a Hewitt lamp placed above; A and B are the endpoints of the diameter of the projection of the lamp on the disc. Each one of points A and B receives from the lamp, the rays of various directions, but all perpendiculars at its speed; each one of them behaves like a mobile luminous point emitting a light identical to that of the lamp; these two points have speeds, equal and opposite, of 100m a second. Let us suppose that the observer, placed at a certain distance in a direction perpendicular to AB, looks at the disc under a very oblique incidence: he will see it in the form of a much elongated ellipse whose end of the axis away from him, while the other comes close. The Doppler Effect must produce a small difference between the wavelengths of radiations coming from these two points, equal to 7×10^{-7} in relative value.

To highlight this difference, we employed an etalon interferometer with silver-plated blades of 65mm thickness, whose rings are observable in a tele-

(1) BELOPOLSKY, *Astrophysical Journal, vol.* **XIII**, 1901, p. 15.
(2) GALITZINE and WILIP, *Astrophysical Journal, vol.* **XXVI**, 1907, p. 49.

scope aiming at infinity. The rotating disc is placed at the focus of a lens having approximately 1m focal length, which rejects the image at infinity and can be seen clearly in the glass at the same time as the rings, so that each point of the field is lit by only one point of the disc. The outgoing beam of the lens is reflected from a mirror, and then passes through the interference standard and the spotting scope; while slightly turning the mirror, you move the image of the disc in the field of the telescope and an edge, then another can be brought to light the center of the rings. If the disc is motionless, this change does not bring any modification in the aspect of the rings; when the disc turns, one sees the rings contracting when one passes from the edge which moves away to that which approaches the observer.

With the green radiation of mercury and the path difference of 130mm, the order of interference is approximately 240,000. While passing from one edge to another, the change is from approximately 1/6 of a ring; this change is easy to note without any measurement.

If one wants to make measurements there is, as usual, great advantage to be had using photography. With the violet line of mercury, a 5 second exposure is enough, even with a camera of very small aperture. We made successive photographs by alternatively employing the two edges of the disc; with such short exposures, which follow one another very quickly, one is completely safe from the effect of the changes of temperature on the interferential apparatus. The order of interference, with this radiation, being of 300,000, the variation is of 1/3 of a ring. One can determine by the ordinary method by measuring on the stereotypes the diameters of the rings. One experiment, made with few precautions, gave a result consistent of almost 2 per 100 with the calculated result.

By improving the details of measurement a little and by using a speed higher and more exactly known, one could easily arrive at a higher precision and thus obtain a rather good method for measuring the speed of light.