

THE PRESIDENT'S ADDRESS
ON THE AWARD OF THE GOLD MEDAL
TO PROFESSOR ANDRÉ DANJON

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The Gold Medal of the Society has been awarded by the Council to Professor André Danjon for his contributions to astronomical photometry, to fundamental astronomy and to the design of astronomical instruments.

It is impossible to read through a mere list of Danjon's published papers without being impressed by his remarkable versatility. In fact his investigations have ranged over so wide a field that it is not possible to describe them adequately in a short statement. But the Council has selected three aspects of his work to form the grounds of this award of the Gold Medal. Two of these are concerned with his skill in the design and use of astronomical instruments of great precision, and it will be convenient to take them together.

In the earlier part of his observational career, from 1919 to 1945, our medallist worked at the Strasbourg Observatory, of which he was Director during the last fifteen years of this period. The principal instrument at the Observatory is a 49 cm refractor of fine quality, and for sixteen years Danjon had the sole charge of it. He used this instrument for a great variety of purposes, but we are here mainly concerned with those lines of research which involved the use of special auxiliary apparatus of his own design.

The many problems of visual photometry seem to have attracted him from an early stage, and he devised several new types of photometer, with a view to eliminating some of the inherent defects of those hitherto employed; and he also gave special attention to certain physiological factors known to contribute to the errors of the estimates. In several of his instruments he adopted the principle of superposition of the fields containing the comparison star and the object under observation, thus avoiding some of the errors due to the common practice of using an artificial comparison star.

He also developed a so-called "cat's eye" photometer, which he found applicable to a variety of photometric researches. With it he made a series of observations of Algol, which yielded results comparable with those obtained by photo-electric means. With the same instrument he made the first complete photometric study of Earthlight on the Moon, comparing the brightness of certain regions with that of the sunlit part of the disk, which he then, with another double-image photometer, compared with the Sun itself. The resulting measures gave him a light-curve of the Earth in relation to phase-angle, together with a mean value for the Earth's albedo, with seasonal variations. Finally he obtained the colour-index of our planet, which proved to be unexpectedly small, showing that the Earth is much less yellow than the other planets, appearing positively blue in comparison with Venus.

He applied his cat's eye photometer to studies of the totally eclipsed Moon, and the distribution of light within the Earth's shadow; while, with another photometer, he made measures of the light of Mercury and Venus, comparing these planets directly with the Sun, reduced optically to a point source. The

light-curve for Mercury was found to resemble that of the Moon, while for Venus the results were similar to those deduced for the Earth.

Finally, he used a specially designed double-image photometer for determining the magnitude of the companion of Sirius.

Another line of work pursued by Danjon with the Strasbourg telescope was the accurate measurement of double stars. For this purpose he designed a special double-image interference micrometer. In this instrument he used square apertures of variable size, a Babinet compensator producing a difference of half a wavelength in the two optical paths. Danjon found that very precise measures of distance were obtainable with this apparatus; and he further developed a new method of computing the orbits of binaries by combining these measures with the position-angles obtained by previous observers. This micrometer, used simply as an interferometer, was found equally useful in measuring very close pairs, and the diameters of such small objects as the satellites of Jupiter. In this work the relatively great amount of light available in this particular instrument was found to be a special advantage.

From the time of his appointment as Director of the Strasbourg Observatory, Danjon began to pay an increasing amount of attention to meridian astronomy, and especially to the problems posed by the inherent optical and mechanical defects of the instruments previously in use. The result of much thought on this subject was the design and construction, in 1934, of a reflecting transit instrument. Briefly stated, this consisted of a small transit, made compact by optical folding. In front of the central part of the 6 cm objective was placed a Wollaston prism, with its reflecting surface in the plane of the meridian. Two images of a star are then seen, one direct and the other reflected, moving apparently in opposite directions and coalescing at the instant of meridian passage. An impersonal micrometer of conventional design is used in the observations. A firmly fixed collimator, used in conjunction with a mercury trough, serves to check the constancy of the optical plane of the prism. Finally, a special eyepiece for nadir observations was designed by Danjon.

The accuracy controls of the whole instrument are purely optical and include a device for determining and allowing for the effects of slight comatic distortions of the axial image of the star under observation. Apart from the micrometers, none of the mechanical parts needs to be constructed with high precision; and the instrumental constants are determined at the moment of each transit.

With this instrument Danjon found that by a single night's observation he could determine time within 6 or 7 milliseconds. This is a remarkable and suggestive result, when it is remembered that the probable errors of the Right Ascensions of the FK3 catalogue, based on work with meridian instruments of conventional design, ranges up to 8 milliseconds.

From the reflecting transit Danjon next turned his attention to an instrument of the same family, the prismatic astrolabe. This is essentially an equal-altitude instrument, and its application is confined to stars which culminate at a limited zenith distance of 30° . This angle is determined by that of an equilateral prism, placed immediately in front of the objective. The form previously evolved by Claude and Driencourt had certain defects, and these Danjon proceeded to eliminate by some ingenious modifications of the optical train. In addition, the instrument was provided with an impersonal micrometer, and there was a device for compensating certain optical effects due to the independent

action of the two halves of the objective. The whole instrument is of great compactness, and although its aperture, like that of the reflecting transit, is only six centimetres, it is capable of determining time with an accuracy comparable with that attainable with a bulky meridian instrument of the ordinary type.

Though a large part of the most outstanding work of our medallist has been, as we have seen, of a practical kind, he has by no means neglected the theoretical side of our science. Among other things, he has developed Laplace's method for the determination of orbits in two different ways; the method of fictitious positions and the method of variations. His *Astronomie Générale* (*Astronomie Sphérique et Éléments de Mécanique Céleste*) published in 1952, is a most valuable contribution to fundamental astronomy, and there is no other book which covers the same ground. Since his organization of the Paris Conference on the Fundamental Constants of Astronomy, in 1950, he has made invaluable contributions, both theoretical and instrumental, to this subject, particularly in regard to the definition of Ephemeris Time and the determination of Universal Time.

He has spent much time in an investigation of the conditions for telescopes and domes, to obtain the best definition; and his work *Lunettes et Télescopes*, written in conjunction with A. Couder in 1935, is the best treatise on all matters relating to telescopes. A second edition of this invaluable work is now in preparation.

Since his appointment in 1945 as Director of the Paris Observatory, Danjon has played a very important part in some of the recent spectacular developments in French Astronomy. In particular he has been largely responsible for the successful prosecution of the plan for establishing a great observatory in Haute Provence, a project in which he has been personally concerned ever since its inception under General Ferrié in 1923. He is now President of the Commission Internationale des Poids et des Mesures, and his high standing in our science has further been recognised by his election as President of the International Astronomical Union.

I have tried to lay before you, however inadequately, the grounds selected by the Council for the award of the Society's Gold Medal. In doing this I have been forced to omit all reference to the many other astronomical activities of Professor Danjon, whose objects of observation have ranged from comets to total eclipses of the Sun, and from occultations to the surface features of Mars. But I should like to conclude by quoting some of his own words, partly because they illustrate his enthusiasm as a practical astronomer, and partly because they seem to accord so closely with the motto of our Society.

“It is the bounden duty of astronomers to think as much about the future progress of Astronomy as about their own particular labours; and their activities should be ruled by the maxim that an observation well made will be found of use at some time or another, while an observation missed may leave a gap that can never afterwards be filled.”