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Obituary Notice

EJNAR HERTZSPRUNG

Ejnar Hertzsprung died on 1967 October 21 in Roskilde, Denmark at the age of 94. He was born on 1873 October 8 in Frederiksberg, then a suburb of Copenhagen.

Hertzsprung inherited his interest in astronomy from his father who had studied it without having taken it as a profession. That the father did not favour an astronomical career for his son either, may be deduced from the fact that the young Hertzsprung took up chemical engineering instead. In 1898 he graduated from the Technical High School in Copenhagen and was thereafter for two years employed as a chemical engineer in St. Petersburg.

A stay of several months at the University of Leipzig was spent studying photo-chemistry under Wilhelm Ostwald. The thorough knowledge of the photographic process acquired by now, Hertzsprung would shortly apply in astronomy in an unrivalled way.

He entered astronomy (1902) at the comparatively late age of 29 as a private astronomer at the Urania Observatory in Frederiksberg and soon began working also at the University Observatory in Copenhagen. He would forever be grateful to H.E.Lau, who taught him the first principles of observational astronomy. With characteristic industry and ingenuity, he obtained a multitude of accurate results in the fields of general photographic photometry, variable stars and double stars, subjects that would absorb his interest for the rest of his long life.

The two papers, which were to attract world-wide attention, appeared in a photographic journal (1905 and 1907). These had the same title, 'On the Radiation of the Stars', and mark the beginning of the HR diagram which holds such a prominent place in modern astronomy in all questions related to the evolution of the stars. He shows from a study of parallaxes, apparent magnitudes, colours and proper motions, that the yellow stars disperse more than four magnitudes in absolute magnitude.

As an example, he mentions Aldebaran and 61 Cyg, with similar colours, but with the first star more than five magnitudes brighter absolutely than the latter. Hertzsprung's original papers were not illustrated by a diagram, probably because he considered the observational data too scanty for that. Russell, unaware of Hertzsprung's previous work, published such a diagram a few years later (1913),

thereby greatly contributing to the spreading of these ideas among astronomers.

It was a principle of Hertzsprung that astronomical equipment should be used for what it is most suitable. And as a natural consequence of this attitude, he fitted his programme to the equipment at his disposal or he would try to obtain observing time at other observatories if his own equipment was not suitable for what he wanted to do.

It has become known only recently that he actually had constructed the first HR diagram for the Pleiades (1906) with apparent magnitudes and effective wavelengths as coordinates. Characteristically he withheld publication as the effective wavelengths were obtained with a refractor instead of with a reflector as they should have been.

As another item of far reaching consequence, we mention his discovery that the stars which, according to Miss Maury, have the c-characteristic in their spectra must be very luminous. With this remark he initiated the study of the spectroscopic absolute magnitude and the spectroscopic parallax. This type of work is still pursued in the present time under the name of calibrating the absolute magnitudes of the MK system of spectral classification, a field of great importance in galactic studies.

The use of coarse objective gratings for the determination of effective wavelengths as colour equivalents was first proposed by K.Schwarzschild. Hertzsprung has used the objective grating extensively for the determination of effective wavelengths, the determination of a photometric scale and for the elimination of magnitude equation in astrometry. He showed that the method of effective wavelengths was as accurate as the photographic determination of the colour-index; it should be realized, of course, that the better modern methods using the photoelectric cell were not then available for the photometry of faint stars.

Hertzsprung moved to Göttingen in 1909 accepting a position as astronomer at the Göttingen Observatory under the great K.Schwarzschild. Within a year, Schwarzschild was appointed director and Hertzsprung astronomer at the Potsdam Observatory. Here he used an objective grating to prove the variability of Polaris. He calibrated Miss Leavitt's relation between apparent magnitude and period of cepheids in the Small Magellanic Cloud by means of mean parallaxes of galactic cepheids (1913). His value for the distance of the Small Magellanic Cloud (10 000 parsec) was larger than any distance determined in the Universe at the time.

It is true that the distance of the Small Magellanic Cloud, presently accepted, is about five times larger than Hertzsprung's result. The discrepancy is due to a number of reasons of which the most important

is his neglect of the then unknown galactic absorption. However, the modern method is similar in detail to Hertzsprung's. So highly was this work regarded by the Council of the Royal Astronomical Society that it was mentioned as one of the main reasons for the award of the Society's gold medal.

He used the 20-in. visual refractor of the Potsdam Observatory for the photographic measurement of double star positions. With painstaking care, possible systematic errors were either altogether eliminated or rendered negligible. He observed northern double stars at Potsdam and Lick. The southern doubles were observed at the Union Observatory at Johannesburg, each photographic plate yielding about a decimal more than the visual method. After his retirement, others took double star plates for him, but he continued to do the measuring himself until he was well over 90.

Russell and Hertzsprung independently invented the method of dynamical parallax for visual double stars. Hertzsprung always felt indebted to observers of former ages and wanted to repay the debt by working for the benefit of future generations of astronomers. He would say: 'We do not know what contemporary observations will be most useful to the astronomer of the future; but we may be sure that he will wish them to be as accurate as we can make them'.

He went to Mount Wilson in 1912 where he obtained the reflector plates for effective wavelengths of Pleiades stars thus improving on his earlier work done with a refractor in Copenhagen. When W.de Sitter became director of the Leiden Observatory in 1918 an astrophysical department was added, headed by Hertzsprung. Co-operation was sought and obtained with the Union Observatory (now Republic Observatory) at Johannesburg in South Africa, an agreement still extremely fruitful in the present day.

He started collecting plates for the study of variable stars in the Southern Milky Way during a visit to Johannesburg in 1923, returning to Leiden with hundreds of plates of the region round η Carinae. The Leiden Johannesburg plate collection now contains nearly 15 000 negatives most of which were taken by Hertzsprung's pupil van Gent. By 1926, he had periods and light curves for so many southern cepheids that the period-form of light curve relation (previously indicated by Ludendorff) could be given a firm observational basis. It is of interest that Christy's contemporary theoretical work on cepheid variability aims at explaining the relation.

In 1922, his interest had returned to the colours of the bright stars. He published an important catalogue of mean colour equivalents of 734 stars brighter than 5·5 and within 95° from the North celestial pole. The reduction of a variety of colour equivalents to a single scale

required the solution of the following problem: to find the best linear relation between two quantities when the observational errors can be neglected in neither. (In the customary least squares problem one of the variables is exact whereas all the observational error is in the other.) Hertzsprung's solution was used by de Sitter when discussing the velocity–distance relation for extragalactic nebulae. Professional statisticians also showed their interest in the treatment.

In his early Leiden years he embarked on yet another comprehensive program of determining accurate relative proper motions in the Pleiades. The results were useful for the separation of the physical members from the field stars; he showed that the internal motions were of the order of the standard error of measurement. Oort used Hertzsprung's Pleiades proper motions for his work on the mean parallaxes of faint stars. Hertzsprung was awarded the Royal Astronomical Society Gold Medal in 1929. His George Darwin Lecture is a lucid account of the wealth of results on the Pleiades collected by him at the time.

Hertzsprung was primarily an observer who could patiently wait for the supreme opportunity and then use it. Thus, he discovered FP Carinae, an eclipsing variable the period of which is an almost exact integral number of synodic month. Minima occurred near full Moon when observations normally cannot be made; his two plates taken during a total eclipse of the Moon allowed him to discover the variable.

Probably his most superb double star plate was of Antares (distance $3''$ and $\Delta m = 4^m$) which he obtained at Johannesburg during exceptionally good seeing with the star near the zenith. He selected this plate for measurement by all the members of the Leiden Observatory staff and other astronomers who happened to visit there. The results proved that even the photographic double star measures were not entirely free from extremely minute personal errors of measurement.

He discovered the first flare star on Harvard plates (DH Car). His most famous eclipsing variable probably is GL Carinae with an eccentric orbit and revolving line of apses.

He succeeded de Sitter as director of the Leiden Observatory in 1935.

The American Astronomical Society of the Pacific awarded him the Bruce Gold Medal in 1937. At the reception of the medal at Berkeley, he gave a lecture with the title 'On Collaboration in Astronomy' which is probably the only occasion in which he explained in public his modest and wise outlook on astronomical research.

Hertzsprung's never-failing enthusiasm and splendid example were of considerable beneficial consequence for astronomy in the Netherlands where he lived and worked for more than 25 years. Most students at the Leiden Observatory knew that the results generally improved, if

his severe criticism was taken at heart. Although he never was very interested in lecturing and tried to avoid it, his lectures were packed with information and very clearly delivered. He corresponded extensively with other astronomers, loading his letters with sound advice.

Hertzsprung was one of the greatest observational astronomers of the twentieth century, comparable in stature to great observers of the past like Tycho Brahe and Bessel.

It is impossible to do full justice to Hertzsprung's work in a short report, and we are painfully aware that no more than the barest outline of his scientific achievement has been recorded here.

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