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VLADIMIR PAVLOVICH LINNIK

(on his eightieth birthday)

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ACADEMICIAN Vladimir Pavlovich Linnik, an outstanding specialist in the field of applied optics, celebrates his eightieth birthday in July 1969.

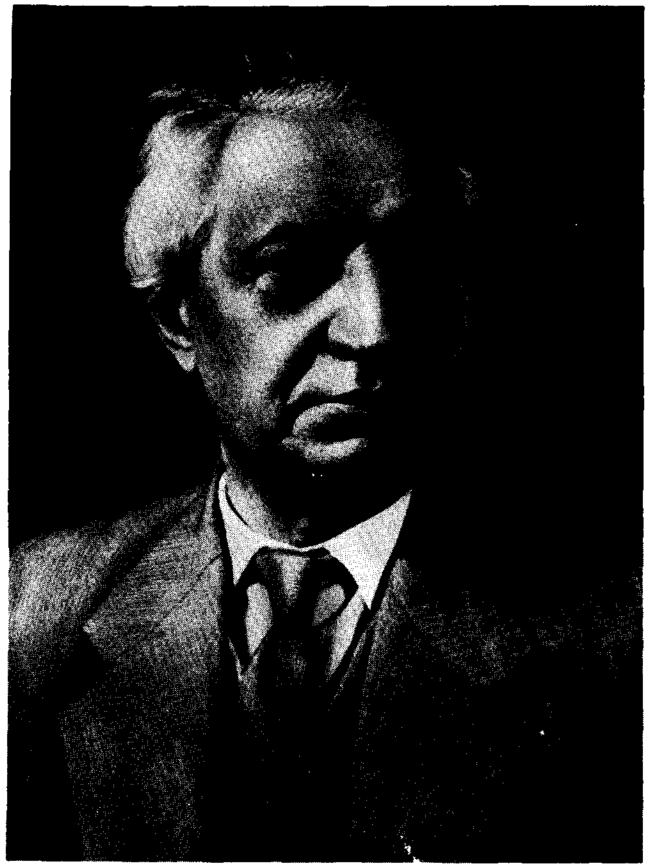
Linnik was born in Khar'kov, the son of a worker. In 1914 he was graduated from the Physics and Mathematics Department of the Kiev University with a first-degree diploma. During the time of the first world war, Linnik organized the manufacture of military optical instruments at the Kiev University. After the end of the war, he taught at the Kiev Polytechnic Institute, and in 1926 he transferred to the State Optical Institute, where he is still active. In 1934, Linnik was awarded the degree of Doctor of Physical and Mathematical Sciences without defending a dissertation. In the same year, he was appointed Professor of the Leningrad State University, where for many years he delivered a lecture course on the theory of optical instruments. In 1939 he was elected a full member of the academy of sciences of the USSR.

Linnik's work followed a variety of paths.

The chronologically first cycle of his work, performed in the 20's and in the early 30's, is devoted to the optics of x-rays. He developed an exact method for measuring the index of refraction of x-rays in various media, first observed Lloyd interference of x-rays, which has made it possible for him to determine directly their wavelength, and developed for the investigation of crystal structure a method named after him. When this method is used, a picture of diffraction fringes is produced on a photographic plate, and the interpretation of this picture is simpler than that of the previously obtained Laue patterns. Many then existing disputes were resolved by clever experiments performed by Linnik. These explained the observed difference between the diffraction patterns of x-rays and electrons, and have shown that x-ray diffraction in a very thin mica plate yields the same picture as electron diffraction. These investigations are now classics and are described in many books devoted to x-rays and their applications.

Simultaneously with work on x-rays, Linnik started to engage in problems of applied optics, particularly investigations of the image quality in optical instruments. He developed several original methods of investigating optical systems. Of particular interest is the "Linnik interferometer with a semitransparent plate," in which he realized for the first time a simple method of obtaining an ideal comparison wave by using diffraction of a light beam passing through a small aperture. This interferometer was used by Linnik to test photographic lenses and other optical instruments, and subsequently was successfully employed to study the form of the light wave produced by a laser.

One of his important activities was the development



of interference and other optical methods for controlling the form and microgeometry of surfaces of machine parts. To this end he proposed a number of original instruments that made it possible for the first time to measure with unprecedented accuracy, by contactless method, the depth of machine-tool tracks on a surface. Widely used both in the USSR and abroad are Linnik's microinterferometer and double microscope, the use of which has played a very important role in the development of precision machinebuilding. In 1945, Linnik invented one more interference instrument, namely the microprofilometer, which extended the capabilities of the microinterferometer, making it possible to measure the depths of not only grooves that are parallel to each other, but also of randomly, directed tracks of machine tools. At the present time, a somewhat modified microprofilometer has come into use, intended for the control of precisely finished internal surfaces of machine parts. It should be noted that there were no instruments for this purpose before, and vital mechanism parts could be checked only after they were machined.

Of considerable interest is also Linnik's interferometer for the monitoring of the linearity of profiles of large flat and cylindrical surfaces (up to 5 meters long). Unlike other instruments, it makes it possible to determine immediately the profile of the surface over its entire length. The interference instruments developed in accordance with Linnik's ideas and under his direction were awarded in 1958 the highest prize at the Brussels Worlds Fair. Linnik together with a group of workers were awarded a state prize for the development and introduction of interference instruments.

Linnik deserves great credit also in the field of microscopy. Together with P. D. Razchenko, he developed and introduced back in 1934 a new method of assembling microscope objectives. This method greatly simplifies the complicated process of centering a large number of objective lenses and makes it possible to obtain a high grade objective using workers of moderate skill. The calculation, preparation, and testing of models of new microscope objectives was also organized under his direction. Our industry now manufactures all types of modern microscope objectives. Later on, Linnik paid much attention to problems in the theory of the microscope and to the development of new methods of microscopic research. Thus, he was the first to propose and develop an interference microscope, which makes it possible to obtain a sharp colored image of a transparent biological object with the aid of an ordinary microscope.

Linnik was one of the first to point out the need for using photoelectronics in optical instruments for the purposes of automatic control. Under his guidance, a large number of optical-photoelectric devices were developed, for example, for the automatic measurements of the aberration of optical systems and to monitor the profiles of flat surfaces, for an exact determination of the position of the null interference fringe, etc.

A special position in Linnik's activity is occupied by work in the field of astronomical instrument construction. Foremost among these is the development, under his direct supervision, of a unique instrument, namely a stellar interferometer with a six-meter base. Unlike the Michelson stellar interferometer, which is intended for the measurement of small angular diameters of stars (on the order of 0.01″), Linnik's interferometer makes it also possible to measure much larger angles (up to 15″) between widely spaced double stars, with accuracy 0.002–0.003″. In addition, the azimuthal mounting of the instrument increases greatly the rigidity of the construction and expands the volume of information obtained during the measurements. The interferometer is now in operation in the Main Astronomical Observatory in Pulkovo.

Other astronomical instruments by Linnik are based on the same principle, viz., an interference passage instrument, an interference angle gauge, and an interference heliometer for particularly accurate measurements of the angular diameter of the sun.

For an exact determination of the local latitude, Linnik developed a zenith collimator which is simpler than the previously employed instrument and gives a higher measurement accuracy.

Linnik proposed a clever method for producing interference reference markers on spectrum photographs obtained with the aid of a slitless stellar spectrograph. The presence of these markers and the procedure developed by Linnik for investigating spectrograms with the aid of a stereo-comparator greatly simplifies the measurements of the Doppler shift of the spectral lines and increases their accuracy. The method was tested both with a slitless spectrograph and with a telescope having an objective prism. It is proposed to introduce this method in the near future at the Byurakan Observatory.

As is well known, the resolving power of large telescopes is much lower than the theoretical value, owing to the inhomogeneity of the atmosphere and the presence of air currents that distort the image of the star. Linnik proposed a very bold idea, namely to compensate for this distortion automatically. The auxiliary mirror of the telescope developed by Linnik is made of several parts, which can move within certain limits in a direction normal to their surfaces. The deformation of the light wave entering the telescope is registered with the aid of an interferometer and several photoreceivers, the electric signals from which control the positions of the sections of the mirror and "correct" the front of the light wave. At the present time, Linnik is successfully working on the realization of his idea, which will uncover new possibilities in the observation and photography of stars. While engaged in the extension of the capabilities of earth-based astronomic instruments, Linnik also pays considerable attention to problems of producing orbital observatories, and in particular to questions of constructing light-weight but large astronomical mirrors.

This is far from a complete list of the work performed by Linnik. Continuous searches for new ideas, the breadth and the boldness in the formulation and solution of new problems connected with various branches of physics, the unexpected nature of the solution of problems, high mastery in the performance of subtle experiments, and deep intuition, are all characteristics of Linnik's working style. A highly skilled mechanic and optician, he frequently constructs himself various parts for laboratory apparatus.

During the many years of his fruitful work, Linnik surrounded himself with a staff of scientific workers, many of whom developed independently the trends started by him, but continued to enjoy his advice and support. Even now, together with intense personal participation in a number of projects, he finds time to direct a large staff of workers in various branches of applied optics.

Linnik was awarded four Orders of Lenin, the Order of Labor Red Banner, and the Order of the Red Star for outstanding services to his country.

Translated by J. G. Adashko