because the wavelength corresponding to the electron is a thousand times shorter than that of ordinary light. But to realize this power, strongly converging or short focus objectives are required. Glass lenses cannot be used. Electric or magnetic fields take their place, and bend or converge the electron streams just as lenses bend or focus light rays.

One could use a series of low power objectives one after the other in a series of stages. But this would make the microscope unduly long and cumbersome. The development of a high power magnetic objective that will give a magnification of 10,000 diameters in two stages is therefore a considerable step in advance.

*Science News Letter, August 4, 1934*

PHYSICS

# Rotor Spins With Force Million Times That of Gravity

A "ROTOR" spinning 160,000 times a minute (over 2,600 revolutions a second) has been constructed by the Swedish Nobel prize winner, Prof. The Svedberg for investigating the behavior of proteins, the material of which living matter is composed.

Protein placed in Prof. Svedberg's apparatus at the University of Upsala, Sweden, when whirled at such speeds has acting upon it centrifugal force a million times the force of gravity.

The enormous force acting outward on the material is sufficient to separate the small protein molecules from the water in which they are dissolved. By watching the rate of motion of the protein molecules their size and weight can be calculated.

In operation the protein is placed in tiny chambers having quartz windows through which the happenings can be photographed. Both ordinary and ultraviolet light are used for illumination.

Prof. Svedberg and his coworkers, G. Boestad and I.-B. Eriksson-Quensel, report their results and difficulties of the work in the British scientific journal *Nature.*

Hemoglobin, for example, when rotated in a centrifugal field equal to 900,000 times gravity moves outward in such a way that it is known that the particles of which it is composed must be the same size. There were 2,400 whirls a second.

So great is the force generated by the rapid rotation that several of the little "rotors" flew apart and "exploded."

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PHYSICS

# Better Standards Proposed For X- and Gamma Ray Strengths

SUGGESTIONS for standardizing measurements of X-ray and gamma ray intensities which should aid medical science in the treatment of cancer by radiation were advanced by Dr. Gioacchino Failla before the Fourth International Congress on Radiology.

Dr. Failla is chief physicist at Memorial Hospital in New York City and one of five American delegates to the Congress.

At present the proper doses of X-rays can be determined with considerable accuracy but deciding the right dose of gamma rays from radium is less certain. In practice, rule-of-thumb tests known from experience often serve as a gauge by which the conflicting and scattered observations of many investigators are judged.

The present unit for measuring X-ray and gamma ray intensities, Dr. Failla declared, is the roentgen or R unit. Two ray beams are now compared by the amount of ionization, or atmospheric electricity, which they will produce in a small air chamber at fixed distances from the source.

For X-rays, where the length of the waves is not so short, the method works with some success. For gamma rays, having much shorter wavelength, the ionization method of determining intensity does not work so well. This is due in part, Dr. Failla said, to the fact that what really needs to be known about a gamma ray beam is its effect on body tissues.

What science now tries to do is to take ionization produced in air and apply the results to tissue which is 800 times more dense. For X-rays this discrepancy seems to make little difference but it does matter for the more penetrating gamma rays.

Dr. Failla suggests that the intensity of gamma rays be determined by the ionization they produce in liquid air rather than in gaseous air. Liquid air and human tissue do not differ greatly in density. It is to be hoped that conditions could thus be achieved approximating more closely those found in actual treatment.

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ASTRONOMY

## Horizontal Telescope Will Aid Astronomer's Comfort

WHEN Gustavus Wynne Cook, banker, manufacturer and amateur astronomer of Philadelphia, Pa., wishes to observe the stars next winter from his private observatory at Wynnewood, near Philadelphia, he will not have to do it from a cold observatory, where the temperature inside and out must be the same.

From a steam heated room he will use a telescope projecting horizontally in through one wall, and by means of remote electrical controls he will operate a 25-inch diameter mirror outside which will reflect the star light into the 15-inch lens of the telescope. A series of dials, electrically connected to the mirror, will enable him to tell where it points, and to set it accurately to any astronomical body within reach. An accurately adjusted electric motor, operating in a manner similar to the electric clocks that one attaches to the lighting circuit, will keep the mirror moving steadily. Thus it will compensate for the earth's turning, and will remain pointed to the star.

This is called a siderostat telescope, and it is believed to be the first of its kind in the United States. It is now reaching completion in the telescope works of J. W. Fecker, in Pittsburgh, and it will be installed within the next few weeks. Already Mr. Cook has several other instruments, including two

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