

of great promise. It must, however, be obtained through some nuclear reaction of bombardment with all the attendant inefficiency.

These difficulties, however, challenge but do not

discourage the scientist. When he has once found the way to the nucleus, the heart of the atom, he will never give up until this new field of chemistry is in complete surrender to the scientific "Blitzkrieg."

## OBITUARY

### RAYMOND SMITH DUGAN

THE death of Raymond Smith Dugan on August 31 deprives American astronomy of one of its best observers.

Born at Montague, Mass., on May 30, 1878, he was of Irish descent through his paternal grandfather, and from his mother received a Puritan inheritance going back to Myles Standish. His early training was characteristic of the New England village in which he lived, and led naturally to Amherst College, where he received his A.B. in 1899. Three years followed as instructor in mathematics and astronomy at the Syrian Protestant College at Beirut, and three more at Heidelberg with Max Wolf—where he discovered a considerable number of asteroids, including (508) *Princetonia*, (516) *Amherstia* and (535) *Montague*, and received his Ph.D. in 1905. Returning to America, he was appointed instructor in astronomy at Princeton, beginning an association of thirty-five years with that university, and with the writer.

The 23-inch equatorial and polarizing photometer of the observatory offered a field of research then new to him, in which he soon became a recognized authority, and continued active for his whole career. Realizing that precise observations are most valuable in cases which are capable of detailed discussion, he specialized on eclipsing variables, seeking to secure highly accurate light-curves for a few stars rather than provisional results for many. This involved great labor—for Z Draconis 1149 sets of 16 readings each—but the soundness of his judgment has been shown by the wealth of information regarding the dimensions, densities, forms, and even the internal constitution, of the stars which can thus be obtained.

Observations of such stars are a lifelong task, for many of them show slow changes in period, most of which are as yet unexplained, and unpredictable, and have to be followed year by year.

The discussion of his observations was made with equal thoroughness, making his monographs excellent reading for the student.

He was the first to detect the brightening of the faint companion on the side heated by the radiation of the primary—generally known as the "reflection effect."

His work was recognized by his advancement to the professorship at Princeton which he held for twenty years, by election to the American Philosophical Society, and as chairman of the Commission on Variable

Stars of the International Astronomical Union. He was an active member of the American Astronomical Society and served as its secretary from 1927 till 1936 and vice-president from 1936 till 1938, to the great satisfaction of its members. In this position, and on the many occasions when he was acting director of the observatory at Princeton during the writer's absence, he showed excellent judgment, executive capacity and diplomatic skill.

He was a good teacher, especially of graduate students. A long series of these inspired by him shared in the photometric observations. In 1937, when he took account of the record, these had made more than 200,000 photometric settings and he himself 300,000.

He bore an important part in the preparation and revision of the text-book on astronomy, in which J. Q. Stewart and the writer shared.

No account of him would be complete without reference to his humor—a combination of Irish wit and dry Yankee shrewdness of expression—which crops out again and again in his reports as secretary and in his whimsical account of work in the old dome at Princeton,<sup>1</sup> which will rouse sympathetic chuckles from those who have never worked with what a student on examination once called a "refractory telescope" and deep memories in those who know the old place.

Shortly after the modern and convenient equipment of the new observatory became available he began to suffer from arthritis, which soon put an end to night work. He bore the physical suffering which followed with unbroken courage and the dry humor characteristic of him. Till within a few months, he continued active research, reducing his accumulated observations and working upon variations in period of eclipsing stars, with the aid of photographic data generously supplied from Harvard. The continued strain of his illness proved too much for his constitution, and the end came.

His widow, a sister and two adopted children survive him.

The writer can not close without an expression of his personal regret at the loss of a colleague with whom in the course of these many years there has never been any occasion of serious difference.

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<sup>1</sup> *Popular Astronomy*, 43: 146, 1935.