Biographical Encyclopedia of Astronomers

Fowler, Ralph Howard

Born Fedsen, Essex, England, 17 January 1889

Died Cambridge, England, 28 July 1944

British theoretical astrophysicist Sir Ralph Fowler is best remembered for being the first to apply the ideas of quantum mechanics to the structure of white dwarf stars, showing that they must be supported by the pressure of degenerate electrons. He was the son of Howard and Frances Eva (*née* Dewhurst) Fowler. His father was an Oxford-educated businessman, and his mother was the daughter of a wealthy cotton merchant. Raised in a privileged childhood, Fowler received his earliest education from a tutor until the age of ten when he enrolled at the Evans Preparatory School. His academic brilliance began to emerge three years later when, following the awarding of a scholarship to Winchester College in 1902, he won school prizes in mathematics and natural sciences. It was particularly Fowler's display of extraordinary mathematical ability that drew attention from his instructors and peers. However, he was

By no means a self-absorbed academic. By all accounts, he was quite an athlete, very personable and popular with his peers, and possessed natural leadership skills, a keen sense of humor, and a hearty laugh. These personal attributes would serve Fowler well and have had untold influence later in the professional interactions he had with pre- and postdoctoral students and colleagues.

Fowler won a scholarship to Trinity College, Cambridge, and received his BA in mathematics in 1911. In 1913, he was awarded the Rayleigh Prize in Mathematics at Cambridge. He took his MA there in 1915

Graduating in the midst of great peril for his country, Fowler enlisted in the Royal Marines. His family was not spared the ravages of World War I suffered by the general population. He lost his younger brother Christopher, who was killed in action at the Battle of the Somme. Fowler himself was severely wounded by Turkish fire during the Gallipoli campaign. Following his discharge from the armed forces, Fowler became part of an elite research group (the Ordnance Board) working on ballistics problems in warfare. For his contribution to this critical defense work, he was awarded the OBE in 1918

After World War I, Fowler returned to Trinity College in 1919 as a lecturer in mathematics. His research at that time was in pure mathematics. At Cambridge, he made the acquaintance of Ernest Rutherford, and the two became close friends. It was Lord Rutherford's influence that was, at least in part, responsible for Fowler's shift in interest to problems of thermodynamics and statistical mechanics, and which helped introduce him to the kinetic theory of gases. He eventually married Lord Rutherford's daughter, Eileen, who bore the couple four children. The eldest, Peter Howard Fowler, was a distinguished cosmic-ray physicist who discovered the presence of both very light elements (lithium, beryllium, and boron) and very heavy ones resulting from r-process neutron captures in cosmic rays. His daughter, C. Mary R. Fowler

(Nisbet), is in turn an astronomer and recent past vice president of the Royal Astronomical Society

In 1922, Fowler began collaborative research with C. G. Darwin on the partition of energy, which led to new techniques involving statistical mechanics to solve problems in physical chemistry. In 1923, he published, with Edward Milne, a fundamental paper on stellar spectra, pressures, and temperatures. They used the Saha equation to show how, as a function of stellar temperature, absorption lines would appear, pass through maximum strength, and then disappear again. This result, published in 1923/1924, in turn fed into the thesis of Cecilia Payne-Gaposchkin, which demonstrated that stars are made mostly of hydrogen and helium, and marked the beginning of Fowler's seminal astrophysical contributions in a series of papers that won him the Adams Prize of the University of Cambridge. These basic papers formed the basis of his outstanding book on *Statistical Mechanics*, published in 1929

However, in 1926, Fowler's most important and far-reaching work was published, linking the degenerate state of a gas obeying quantum (Fermi-Dirac) statistics to white dwarf stars. It is no small indicator of Fowler's preeminence that Subrahmayan Chandrasekhar, when offered a special scholarship from the government of India to further his studies in England, chose Fowler with whom to carry out his research. Chandrasekhar's first research paper on quantum statistics was sent to Fowler, who, of course, had already applied the new (Fermi-Dirac) statistics to explain white dwarfs. Fowler's calculation had used quantum mechanics but only Newtonian gravitation. Chandrasekhar incorporated first special and then general relativity into the calculation, thereby establishing the maximum possible mass for white dwarfs. Fowler's other research students included two other Nobel Prize winners (Paul A. M. Dirac and Neville Mott) and ten other Fellows of the Royal Society (London). He also influenced Arthur Eddington and William McCrea.

Fowler continued research on thermodynamics and statistical mechanics into the 1930s, and in 1932, he took a position at the Cavendish Laboratory in Cambridge and was elected to the Plummer Chair in Theoretical Physics. Unfortunately, he developed a serious illness in 1938. As war again loomed in Europe, Fowler once again resumed his defense work with the Ordnance Board, despite his illness, and was selected to become a liaison between the United Kingdom and the United States and Canada. He was knighted in 1942. Fowler continued his work with the Ordnance Board upon returning to the United Kingdom and finally succumbed to his illness.

Edward Sion

Selected **References**

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