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OBITUARY

James A. Van Allen (1914–2006)

Magnetospheric and space physicist, discoverer of the eponymous belts.

James A. Van Allen, who died in Iowa City on 9 August, was a native of Iowa — he was born in the small town of Mount Pleasant on 7 September 1914 — and lived and worked there for most of his life. But his influence, as a founding father of magnetospheric physics and world-renowned leader in the scientific exploration of space, extended far beyond the boundaries of his home state.

After attending both high school and the Iowa Wesleyan College in Mount Pleasant, Van Allen went to the University of Iowa in Iowa City, where he graduated with a PhD in physics in 1939. Following a spell in the department of terrestrial magnetism at the Carnegie Institution in Washington DC, Van Allen moved shortly after the outbreak of the Second World War to the Applied Physics Laboratory of Johns Hopkins University in Silver Springs, Maryland. There he worked to develop proximity fuses that allowed anti-aircraft shells to detonate automatically when reflected radio waves indicated the approach of a target. When the development phase of this project was finished, he was commissioned as a lieutenant in the US Navy and sent to the Pacific to test the fuses under combat conditions. For this assignment, he received four combat stars.

After the war, back initially at Johns Hopkins, and from 1951 as head of physics at the University of Iowa, Van Allen pioneered the use of Geiger tubes to measure cosmic rays at high altitudes. These tubes were initially attached to captured German V-2 and US Aerobee rockets, but Van Allen soon developed his own low-cost, balloon-borne rocket — which he called a rockoon — to carry out the studies at similar altitudes. The first comprehensive latitudinal survey of cosmic-ray intensities above Earth's atmosphere followed, using a series of rockets launched from ships as part of the 1957–58 International Geophysical Year.

During this period, Van Allen was also engaged in the development of an artificial satellite as part of the navy's Vanguard programme. On 4 October 1957, before these plans came to fruition, the Soviet Union launched the world's first satellite, Sputnik 1. In the ensuing frantic catch-up effort, Van Allen was asked to put his Geiger-tube instrumentation on a spacecraft, Explorer 1, to be carried by a rocket developed by Wernher von Braun. The spacecraft launched successfully on 31 January 1958.

Strapped to Explorer 1, the Geiger tube produced what seemed to be erratic results. When passing over terrestrial receiving stations, it sometimes transmitted the expected cosmic-ray counting rates, and at other times did not count at all. A similar instrument on the Explorer 3 spacecraft carried a tape recorder that could record the counting rate for an entire orbit. This revealed that the periods of apparent non-operation were caused by extremely intense charged-particle radiation, thousands of times more intense than the cosmic-ray background, that were simply saturating the counter. The Van Allen belts — two doughnut-shaped regions of energetic charged particles surrounding Earth — had been discovered.

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This entirely unexpected find attracted worldwide attention. Van Allen and his colleagues soon showed that the particles of the radiation belt — mainly protons in the inner belt and electrons in the outer belt — were trapped in stable, long-lived orbits by Earth's magnetic field. Over the nearly 50 years since the discovery of the belts, the study of this trapped radiation and its many effects, such as magnetic storms and auroral light emissions, has blossomed into a wide field known as magnetospheric physics.

Not content with his pioneering work on Earth's magnetosphere, Van Allen extended his research to other planets. He and his colleagues built similar Geiger-tube instrumentation for the Mariner 2 and 4 flights to Venus and Mars, respectively, and the Pioneer 10 and 11 flights to Jupiter and Saturn. Although Venus and Mars did not have radiation belts, Jupiter and Saturn were shown to have very large magnetospheres. As Pioneers 10 and 11 moved outward from the Sun, they also performed the first studies of the entry of cosmic rays into the heliosphere. This is the region around the Sun in which the solar wind — the stream of charged particles given off by its surface — has a controlling influence.

During his career, Van Allen published prolifically, producing more than 275 research papers and several books, one of which, *Origins of Magnetospheric Physics*, gives a detailed account of the early days of that field. He received many honours and prizes for his pioneering work in the field of space research, including the National Medal of Science in 1987, and the Crafoord prize — awarded by the Royal Swedish Academy of Sciences in disciplines outside the Nobel prize categories — in 1989.

Van Allen was also an outstanding teacher and mentor. He routinely taught a large, very popular undergraduate course in astronomy, and placed a strong emphasis on student involvement in his research. Many of his 34 PhD and 48 MSc students went on to become leaders in magnetospheric and space physics. That in turn gave university-based research a leading role in the US space programme, a role that endures today.

Van Allen's influence on his profession was immense. He served on many local and national scientific advisory committees. A strong proponent of robotic spacecraft, he became a persistent critic of human spaceflight, especially of the space shuttle and the International Space Station. He regarded these missions as inordinately expensive relative to the results obtained.

For his qualities of humanity and leadership in space science, James Van Allen will be missed by all who knew and worked with him.

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