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The discovery of magnetohydrodynamic waves

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The existence of magnetohydrodynamic waves was discovered by Hannes Alfvén. The discovery illustrates Alfvén's outstanding ability to derive results of great generality from analysis of specific problems. In developing a theory of sunspots and the sunspot cycle he recognized the existence of a mutual interaction between the motion of the solar plasma and the strong magnetic fields known to exist in sunspots. Until then magnetohydrodynamics and electromagnetism had been well developed but separate fields of physics. By combining them Hannes Alfvén opened an entirely new field of physics – magnetohydrodynamics. He formulated the mutual interaction between fluid motion and electromagnetic fields, and the resulting waves, in an admirably simple and clear way in a famous letter to Nature in 1942. In spite of this, the existence of magnetohydrodynamic waves, now called Alfvén waves, was not generally accepted in the scientific community until 1948. Experimental confirmation came still later. The first experiments were published in 1949 (experiments in mercury) and 1954 (experiments in liquid sodium), but the waves in liquid metals were very strongly damped. In 1960 experiments in plasma were published, which demonstrated weakly damped Alfvén waves with propagation and reflection properties in beautiful agreement with Alfvén's theory. The discovery of magnetohydrodynamic wases opened a whole new field of physics – magnetohydrodynamics. The importance of magnetohydrodynamic waves as well as magnetohydrodynamics in general has increased dramatically as a result of two developments. One is the thermonuclear research effort which made it possible to create high temperature magnetized plasmas in laboratories on the Earth. The other was space research, which made it possible to make *in situ* observations and even active experiments in the magnetized plasma that constitutes almost all of the (known) matter in the universe. In both these areas of research magnetohydrodynamic waves play a fundamental role.