Hannes Alfven presents findings of plasma universe in paper delivered at meeting of American Geophysical Union in San Francisco

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HANNES ALFVEN TELLS OF PLASMA UNIVERSE

Hannes Alfven, Nobel Prize winner and physicist at the University of California, San Diego, says the solar system originated, not from a fiery explosion, but from a universe composed primarily of cosmic plasmas.

"Our present knowledge of cosmic plasmas makes it possible to reconstruct those events of four billion to five billion years ago which resulted in the formation of the solar system," Alfven said.

The Swedish physicist, who divides his time between UCSD and the Royal Institute of Technology in Stockholm, presented his findings in a paper delivered Dec. 13 at the annual meeting of the American Geophysical Union in San Francisco.

Scientists are viewing the cosmic environment differently than they did ten years ago because of recent dramatic advances in the understanding of the properties of cosmic plasmas, according to Alfven. "To a large extent, these advances originate from new observational material which space research has supplied," he said.

Plasmas are hot gasses which are partly or fully ionized (stripped of their electrons) and are capable of conducting electricity and sustaining their own magnetic fields. Alfven, who won the Nobel Prize in 1970 for work in plasma physics, has long maintained that more than 99 percent of the universe consists of plasma.

"Up until now, people haven't recognized the importance of plasma processes, or electromagnetic effects, in the evolution of the solar system," he said. "Many of my colleagues think in terms of mechanical forces only."

Space research, including data sent back by spacecraft, has enabled scientists to observe x-rays and gamma rays in studies of the cosmic environment. "The universe as seen in these wavelength regions is drastically different from our visual universe," he said.

Alfven's scenario for the origin of the solar system begins with the formation of the sun from a dusty interstellar cloud. The dusty plasma left over from the sun's formation falls into place around the sun and begins to rotate, he said.

The pattern of the plasma's rotation is defined by the balance between the sun's gravitational pull and the combined power of orbital centrifugal force and electromagnetic forces; two-thirds of the solar gravitational force is offset by the centrifugal force and one-third by electromagnetic forces, he said. The plasma condenses, forming small bodies called planetesimals.

At the condensation, the electromagnetic forces disappear. Now operating alone, the centrifugal force is insufficient to keep the plasma in equilibrium with the gravitational pull of the sun. The result, he explained, is a two-thirds reduction of the distance between the sun and the bodies orbiting around it.

"The planetesimals aggregate to planets. Around some of them, the same processes are repeated in miniature, which leads to the formation of satellites," Alfven said.

He believes that the data sent back to earth by the Voyager mission to Saturn supports his position. Referring to a stunning satellite photograph of the ringed planet, Alfven said, "This is the most beautiful of all the images NASA has produced. Aesthetically--and, perhaps of greater importance, scientifically."

His plasma model of the universe enables scientists to analyze the structure and composition of the planet's rings. At the same time, the structure of the planet's rings are a "time capsule," he said, containing the evolutionary history of the solar system.

"The bulk structure of the Saturnian ring may very well have been formed at the plasma-planetesimal transition four billion to five billion years ago."

Alfven said there is solid evidence for this notion. In measurements of Saturnian rings, he found gaps where two of the planet's major satellites, Mimas and Janus, orbited prior to the two-thirds contraction in the solar system. In other words, today the "gaps" should be found at two-thirds of the original distance between Saturn and its satellites. And that's where they are found.

He has discovered additional evidence of the two-thirds effect in Saturn's great inner ring, the C ring, which consists of many small "ringlets" and regions of maximum and minimum plasma density.

"A further development of this approach can be expected to lead to a more detailed theory of the formation of planets and satellites and, hence, connect with geology, paleobiology, and related sciences.

"Extrapolation backward in time will give us important information about the structure of the solar nebula and the formation of the sun and, hence, connect with galactic astronomy in general," he concluded.

Alfven is generally regarded as the father of the modern discipline of classical physics known as hydromagnetism. He is the author of the book, "Cosmical Electrodynamics," published in 1950 and generally considered a classic in the field. Alfven's most recent book is "Cosmic Plasma," in which he elaborates on the ideas presented during this and earlier meetings of the American Geophysical Union.

(December 9, 1985) For more information contact: Susan Pollock, 452-3120