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Cosmic magnetic fields

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Dr. Richard Wielebinski is Polish-born Australian radio astronomer, and is one of the world's leading experts on cosmic magnetic fields. He earned a Master's degree of Engineering Science from the University of Toronto in 1958, and a Ph.D. from Cambridge in 1963. He served as the director of Max-Planck-Institut für Radioastronomie from 1969 to 2004. He works mostly on instrumentation in radio astronomy, magnetic fields in the universe, pulsars and history of radio astronomy. In 1992, he received the Max-Planck Research Prize, and in 1995, he received the N. Copernicus Award from Polska Akademia Umiejetnosci.



Abstract

The history of magnetic fields is long. Magnetic fields were used for showing direction in ancient China. They were known in Greece 2000 years ago. Arab sailors transferred the compass to Europe in the Middle Ages. Another old connection to magnetic fields is the use of the polarization properties of Iceland Spar, a bi-fringent crystal, that was used in navigation by the Vikings. The magnetic field of the Earth was studied and used for navigation for many years. Zeeman discovered that polarization splitting of spectral lines occurs in a magnetic field. This effect could then be used to remotely detect magnetic fields: almost immediately after Zeeman's publication Hale (1908) made the first detection of a cosmic magnetic field in the sunspots. Observations of the optical polarization of starlight, made in 1949, gave us another method of remote sensing of magnetic fields. Radio astronomy gave us the most direct observational capabilities. The dominant radio emission comes from the synchrotron process and is polarized. Thus the observation of the radio polarization gives us information about the magnetic fields, normal to the line of sight, in emission regions. The emitted polarized radio waves are also subject to Faraday rotation in thermal interstellar regions. The observation of the Faraday rotation gives us another method of measuring magnetic fields in the line of sight. Also the Zeeman Effect can be observed at radio frequencies. In the past 50 years we accumulated a huge new data base on cosmic magnetic fields. We can now say that practically every cosmic object has a magnetic field. We have observed magnetic fields in comets, stars, pulsars, supernova remnants, galaxies, radio galaxies and in clusters of galaxies. We have shown that the most distant quasars emit non-thermal, synchrotron radiation and hence have magnetic fields. In my talk I will span the whole field of observational results on cosmic magnetic fields. I will also touch on the current theoretical interpretations of the origin of cosmic magnetic fields.

All are welcome! Tea, coffee, biscuits will be served at 2:45

