Prof. Raymond Hide
Professor

Most important awards, prizes and academies

Awards: Chree Medal, British Institute of Physics (1974); Holweck Medal, French Physical Society (1982); Gold Medal, Royal Astronomical Society (1989); Commander of the British Empire (1990); Bowie Medal, American Geophysical Union (1997); Hughes Medal, Royal Society (1998); Richardson Medal, European Geophysical Society (1999); Symons Gold Medal, Royal Meteorological Society (2003). *Academies*: American Academy of Arts and Sciences (1964), Royal Society (1971); Academia Europaea (1988); Pontifical Academy of Sciences (1996). *President*: Royal Meteorological Society (1974-76); Royal Astronomical Society (1983-85); European Geophysical Society (1982-84). *Honorary Degrees*: Leicester (1985); Manchester, Institute of Science and Technology (1994); Paris (1995).

Summary of scientific research

Main contributions in geophysics (geomagnetism, meteorology, geodesy, oceanography, etc.), planetary physics, fluid mechanics and nonlinear dynamics. His work on the hydrodynamics and magnetohydrodynamics (MHD) of spinning fluids has elucidated flow phenomena in planetary atmospheres, oceans and interiors. In laboratory studies of 'sloping thermal convection' he discovered various régimes of 'vacillation' and other multiply-periodic flows and aperiodic flows ('geostrophic turbulence'), which findings (a) influenced seminal mathematical studies of

deterministic chaos and (b) provided a paradigm for interpreting large-scale flows in planetary atmospheres. Other contributions include the concept of 'dynamic superhelicity' as well as general theoretical results tested by crucial laboratory experiments on boundary layers and detached shear layers. His research on fluctuations in the Earth's rotation led to new developments in meteorology, oceanography and studies of the Earth's deep interior. He introduced new types of self-exciting dynamo which show promise as low-dimensional theoretical models for investigating temporal fluctuations of stellar and planetary magnetic fields, including the irregular timeseries of geomagnetic polarity reversals. His discovery of 'nonlinear quenching' made during the course of this work has wide implications in the study of nonlinear systems. His contributions to electrodynamics and MHD include the concepts of 'potential magnetic field' and 'electrodynamic superhelicity' and discoveries of (a) basic theorems and other general results, (b) new types of MHD wave motion expected to occur in spinning planets and stars, (c) methods for locating interfaces and investigating their properties. He initiated research on the electromagnetic effects of hypervelocity impacts in connection with the magnetism of small bodies (Moon, meteorites, asteroids) in the Solar System.

Main publications

More than 230 papers in learned journals, including: Hide, R., Experiments on thermal convection in a rotating liquid, *Quart. J. Roy. Meteorol. Soc.*, 79, p. 161 (1953), *Phil. Trans. Roy. Soc.*, A250, pp. 441-78 (1958); Hide, R., Hydrodynamics of the Earth's core, *Phys. Chem. Earth.*, 1, pp. 94-137 (1956); Hide, R., Hydrodynamics of Jupiter's atmosphere, *Mem. Soc. Roy. Liège*, 7, pp. 481-505 (1962); Hide, R., Free hydromagnetic oscillations of the Earth's core and the theory of the geomagnetic secular variation, *Phil. Trans. Roy. Soc.*, A259, pp. 615-47 (1966); Hide, R., Planetary magnetic fields, *Planet. Space Sci.*, 14, pp. 579-86 (1966); Hide, R., Motions of the Earth's core and mantle and variations of the main geomagnetic field, *Science*, 157, pp. 55-6 (1967), see also Interaction between the Earth's liquid core and solid mantle, *Nature*, 222, pp. 1055-6 (1969); Hide, R., Dynamics of the atmospheres of the major planets, *J. Atmos. Sci.*, 26, pp. 841-7 (1969); Hide, R., Magnetohydrodynamic oscillations of neutron stars, *Nature*, 229, pp. 114-5 (1971); Hide, R., Comments on the Moon's magnetism, *The Moon*, 4, p. 39 (1972); Hide, R., How to locate the electrically-conducting fluid core of a planet from external magnetic observations,*Nature*, 271, pp. 640-1 (1978); Hide, R., The magnetic flux linkage of a moving medium: a theorem and geophysical applications, *J. Geophys. Res.*, 86, pp. 11681-7 (1981); Hide, R., The magnetic analogue of Ertel's potential vorticity theorem, *Ann. Geophys.*, 1, pp. 59-60 (1983); Hide, R., Superhelicity, helicity and potential vorticity, *Geophys. Astrophys. Fluid Dyn.*, 48, pp. 69-79 (1989); Hide, R., Fluctuations in the Earth's rotation and the topography of the core-mantle interface, *Phil. Trans. Roy. Soc.*, A328, pp. 351-63 (1989); Hide, R., Sloping convection: a paradigm for large-scale waves and eddies in planetary atmospheres (with Lewis, S.R. and Read, P.L.), *Chaos*, 4, pp. 135-62 (1994); Hide, R., On the effects of rotation on fluid motions in containers of various shapes and topological characteristics,*Dyn. Atmos. Oceans*, 27, pp. 243-56 (1997); Hide, R., Nonlinear quenching of current fluctuations in a self-exciting homopolar

dynamo, *Nonlinear Processes in Geophysics*, 4, pp. 201-5 (1997); Hide, R., Generic nonlinear processes in self-exciting dynamos and the long-term behaviour of the main geomagnetic field, including polarity superchrons, *Phil. Trans. Roy. Soc.*, A358, pp. 943-55 (2000); Hide, R., Helicity, superhelicity and weighted relative potential vorticity: Useful diagnostic pseudoscalars?, *Quart. J. Royal Meteorol. Soc.*, 128, pp. 1759-62 (2002); Hide, R., Quenching Lorenzian chaos (with McSharry, P.E., Finlay, C.C., and Peskett, G.D.), *Int. J. of Bifurcation and Chaos*, 14, pp. 2875-84 (2004); Hide, R., Reflections on the analogy between the equations of electrodynamics and hydrodynamics, pp. 25-33, and, Potential magnetic field and potential vorticity in magnetohydrodynamics, pp. 34-6, in *Meteorological and geophysical fluid dynamics* (a book to commemorate the centenary of the birth of Hans Ertel) (ed. W. Schroeder), Bremen, Deutsches Arbeitskreis Geschichte Geophysik und Kosmische Physik (2004); Hide, R. & Moroz I.M., Physically-realistic self-exciting Faraday-disk dynamos, *Mathematical Aspects of Natural Dynamos* (eds. E. Dormy & A.M. Soward) (2005); Hide, R., Geomagnetism, "vacillation", atmospheric predictability and "deterministic chaos", The Pontifical Academy of Sciences, *Acta 18*, pp. 257-4 (2006); Hide, R., 'Proudman-Taylor theorem' and 'Potential vorticity and potential magnetic field theorems', *Encyclopaedia of Geomagnetism and Palaeomagnetism* (eds. D Gubbins and E. Herrero-Bervera), Springer (2007).