PHYSICS AND ASTRONOMY COLLOQUIUM

A Solution of the 'Dynamo Problem'

Friday, February 14 | 3:30-4:45 p.m. | Planetary Hall 120

The 'dynamo problem' requires that the origin of the primarily dipole geomagnetic field be found. Throughout history, Earth's magnetism has been evident but only slowly understood. It was only in the 1800's that Carl Gauss was able to build a magnetometer to measure both magnitude and direction of the geomagnetic field and also to determine its spherical harmonic coefficients. In 1919, Joseph Larmor suggested that solar and planetary magnetism was due to internal motions of electrically conducting fluids. The search for an answer seemed to fall within the purview of magnetohydrodynamics (MHD). That MHD was appropriate was finally shown in the 1995 numerical simulations of Gary Glatzmaier and Paul Roberts, simulations that produced an Earth-like magnetic field including a dipole reversal. However successful the numerical simulations were, the theoretical origin of the primarily dipole geomagnetic field remained unknown. Here, I discuss how the origin is found in the statistical theory of MHD turbulence, thus solving the 'dynamo problem.'

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John Shebalin is an Affiliate Research Professor at George Mason University where he teaches a course on magnetohydrodynamics. He retired from NASA as an Astrophysicist in 2017, after 30 years of service. His primary research interest is in magnetohydrodynamic turbulence, particularly in dynamo processes that produce large-scale planetary and stellar magnetic fields.

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