A new way to measure Earth's magnetosphere

US researchers have demonstrated the potential use of a new way to measure properties of Earth's magnetosphere, the magnetic bubble that surrounds the planet.

Zhai et al. used a property known as Faraday rotation for radio tomographic imaging of the magnetosphere.

Faraday rotation occurs when a linearly polarized light wave travels through a magnetized medium such as the magnetosphere. The magnetic field causes the plane of polarization to rotate, and the amount of rotation is directly proportional to the electron density in the medium and to the magnetic field. Therefore, because Earth's magnetic field is known, researchers can use measurements of Faraday rotation to reconstruct electron density in the magnetosphere.

Using receivers on the Wind spacecraft, the researchers measured the polarization of radio signals transmitted by the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) spacecraft. They used the polarization data to reconstruct a two-dimensional electron density image of Earth's magnetosphere in the north polar region.

The researchers find that the electron density determined by this method agrees well with empirical models of electron density. Such measurements could lead to improved understanding of large-scale processes in the magnetosphere.


Abstract
Recent theoretical studies have shown the feasibility and potential scientific value of radio