

Visualizing Planetary Magnetic Fields (and Why You Should Care)

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Introduction

- The magnetic fields of the large terrestrial planets, Venus, Earth, and Mars, are all vastly different from each other.
- These differences can tell us a lot about the interior structure, interior history, and even give us clues to the atmospheric history of these planets.
- Unfortunately, magnetic fields are invisible and, consequently, can be difficult to visualize.

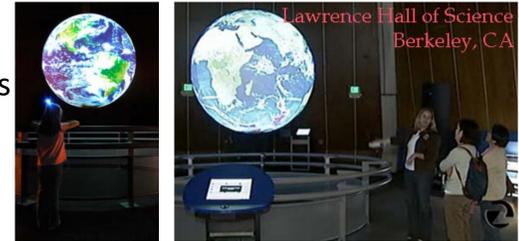
- This leaves us with two questions:

Question #1: How can we best communicate the structure of these planetary magnetic fields to the public?

Question #2: How can we best communicate the importance of studying planetary magnetic fields?

- We address these questions by 1) developing a series of presentations given on visually engaging spherical displays and 2) creating scientifically accurate 3-D models of planetary magnetic fields.

• Lawrence Hall of Science's *Science on a Sphere*[®]



• *Magic Planet*[®] portable digital video globe from *Global Imagination*[®]

Presentations

- Our first presentation is targeted to an **elementary school age** audience – *Goldilocks and the Three Planets*
- Focus is mainly on differences in the atmospheres of the terrestrial planets and why Earth can support life
- Venus is too hot; Mars is too cold; Earth is just right for water
- Water made Earth habitable: water removed Earth's CO₂
demo: vinegar + limestone = bubbles of CO₂ → CO₂ in rocks!

- Our second presentation is targeted to a **middle school age** audience – *Lost on Mars (and Venus)*
- Focus on differences in the magnetic fields using “global compass maps” (see me for examples)
- Due to differences in how magnetic fields are formed
Earth: planetary dynamo in deep interior
Mars: surface rocks trap/remember magnetic field
Venus: no field; its interior is “different” than Earth's

- Our third presentation is targeted to a **high school age** audience – still a work in progress
- Focus on the effect of differences in the magnetic fields
- In the absence of a global magnetic field (Mars and Venus-like), the *solar wind* can slowly strip away the atmosphere
- Global planetary magnetic fields (Earth-like) can protect atmospheres from the solar wind
- Planetary magnetic fields are important for long term atmospheric and climate evolution

3-D Models

- Wires represent magnetic field lines
- Mars – (felt like) years in the making
Photographic World Premier!
(We affectionately call him George)
- Venus and Earth are forthcoming – some previous examples at far left

