# Seeing the Earth spin

**Jayant Narlikar & Thanu Padmanabhan**

You have been taught that the Earth spins around its axis from west to east once every 24 hours. It is this spin which makes celestial bodies (like the Sun) appear to rise in the east and set in the west. Is it possible to see the effect of the spin of the Earth right before your eyes without referring to the celestial bodies?

This is indeed possible as was shown by Leon Foucault (pronounced "Foo-koh"), nearly 158 years ago, on February 3, 1851. His apparatus consisted of a long pendulum which was free to oscillate in any vertical plane. When he let it swing, it was seen that the plane in which the pendulum was oscillating itself started rotating in course of time. The cause could be traced to the spin of the Earth!

This result is quite easy to understand if you imagine this experiment being performed, say, at the North Pole of the Earth. At the North Pole, the pendulum will swing in some fixed plane while the Earth spins underneath it once in every 24 hours. Viewed from the Earth, we will see that the plane of oscillation of the pendulum rotates once in 24 hours in the clockwise direction. Similarly, at the South Pole we will see its rotation in the counter-clockwise direction.

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At any other latitude, the same effect occurs but at a rate slower than at the poles. This is because only the component of the Earth's spin in the vertical direction, at any given location, contributes to this effect. At the poles, the full strength of the Earth's spin is felt by the pendulum while at any other latitude the vertical component of the Earth's spin is reduced - leading to reduction in this effect. This means that the Foucault pendulum takes longer than 24 hours to complete one full rotation at intermediate latitudes. For example, the Foucault pendulum at the foyer of IUCAA, Pune does this in about 75 hours. As you could have guessed, the plane of oscillation of the pendulum does not rotate at the Equator. Foucault was lucky that Paris was not located at the Equator!

The initial demonstration of the Foucault pendulum took place on February 3, 1851 in the Meridian Room of the Paris Observatory. The first titular president of the French republic, Louis-Napoleon Bonaparte, permitted Foucault to use the Pantheon in Paris to give a demonstration of his pendulum (with a 67 meter wire and a 28 kg pendulum bob) on March 31, 1851. In this impressive experiment, Parisians could see the plane of oscillation of the pendulum rotating in a clockwise direction (when viewed from the top) making one full circle in about 32.7 hours. One could thus see the evidence for spin of the Earth without having to look at the sky and this demonstration created a sensation amongst lay persons and scientists.

**(Next week: Isaac Newton: Who Started It All)**

*Astrophysician Jayant Narlikar and Thanu Padmanabhan, theoretical physicist, will contribute to DNA's special series through 2009, designated the International Year of Astronomy.*