Parsecstones in Astronomy - 2 *J V Narlikar*

Does the Earth Move?

'E pur si muove' ('Yet, it does move') said Galileo in 1633 even after recanting and supporting the geocentric theory. Is the Earth fixed and the Sun goes round it or vice versa? The debate had been a long standing one. The relativist today may say: does it matter? Aren't the laws of physics the same, whichever frame of reference you find convenient to use? Indeed, in a purely two-body system the question of what goes round what is undecidable.

But astronomers have more than two bodies to deal with. Apart from the planets in our neighbourhood, there is the background of stars. With respect to that background the question of what goes round what does become meaningful. And it is in principle decidable. Aristarchus of Samos in Greece, back in the third century B.C. was the main proponent of the heliocentric theory. His idea was put to a test: at six month intervals the stars should appear to change their direction because of the change of the observer's vantage point as the Earth moves through space.

The idea was right but Aristarchus lost the debate for two reasons. First, his contemporaries had grossly underestimated the stellar distances and had expected appreciable angular changes of star directions, which were not found. Second, the astronomical techniques of his times were not accurate enough to measure the changes of the order of 0.1 arc second that were in fact there.

Even Galileo, despite his confidence in the heliocentric theory, did not have the correct test of his claim. His notion that the Earth's motion causes tides of oceans was wrong. The real tests of the hypothesis came in the 18th and 19th centuries. The parallax test proposed by Aristarchus was first used by Bessel for a reliable result in 1838 for the Star 61 Cygni, whose parallax is about 0.3 arc second. An earlier test of Earth's motion came in 1725 from aberration measurements by Bradley who measured the change in the direction of light coming from a star as perceived from the moving platform of the Earth.