

Planet earth learns to rock*

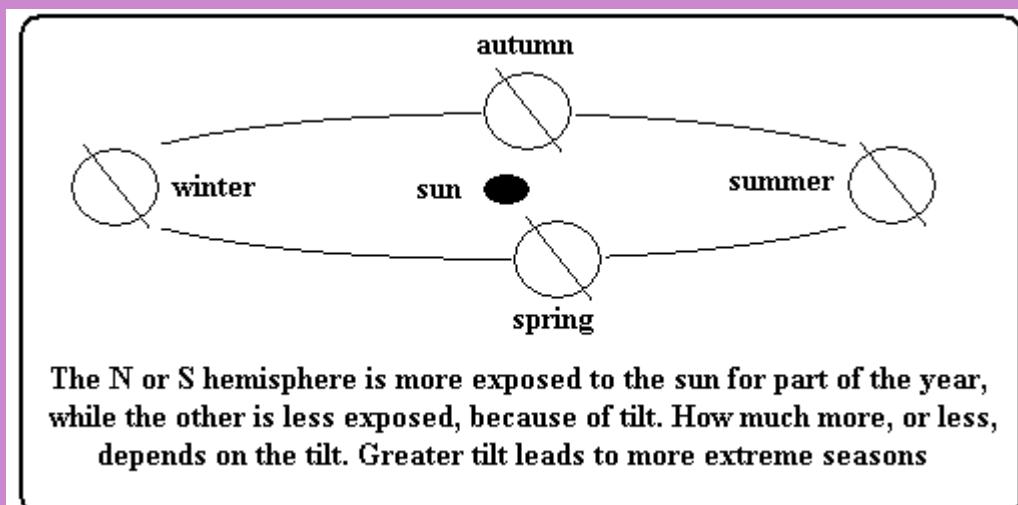
(*due credit to MLTR)

The rise and fall of rodent population on the earth, over the millennia, is found to connect with changes in the earth's orientation in space, says S.Ananthanarayanan.

A report in this week's *Nature* says fossil records are filling gaps left by geological methods.

Changing orientation

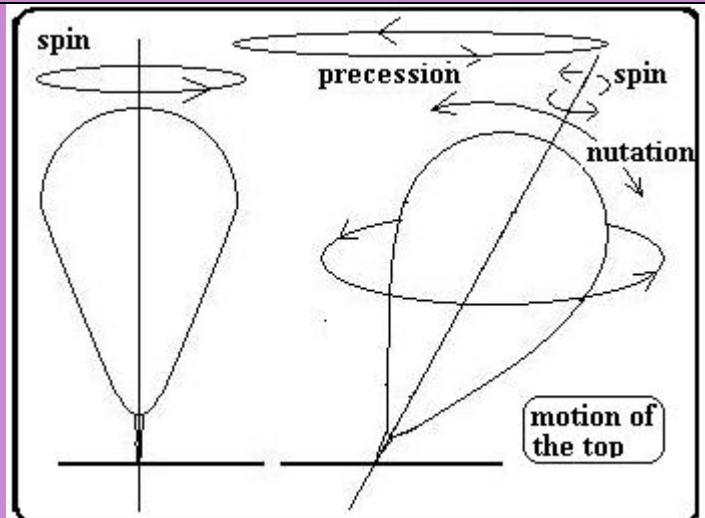
The spinning of the earth has an axis of spin and so has the motion of the earth around the sun. It is these movements that give rise to night and day and the change of seasons and



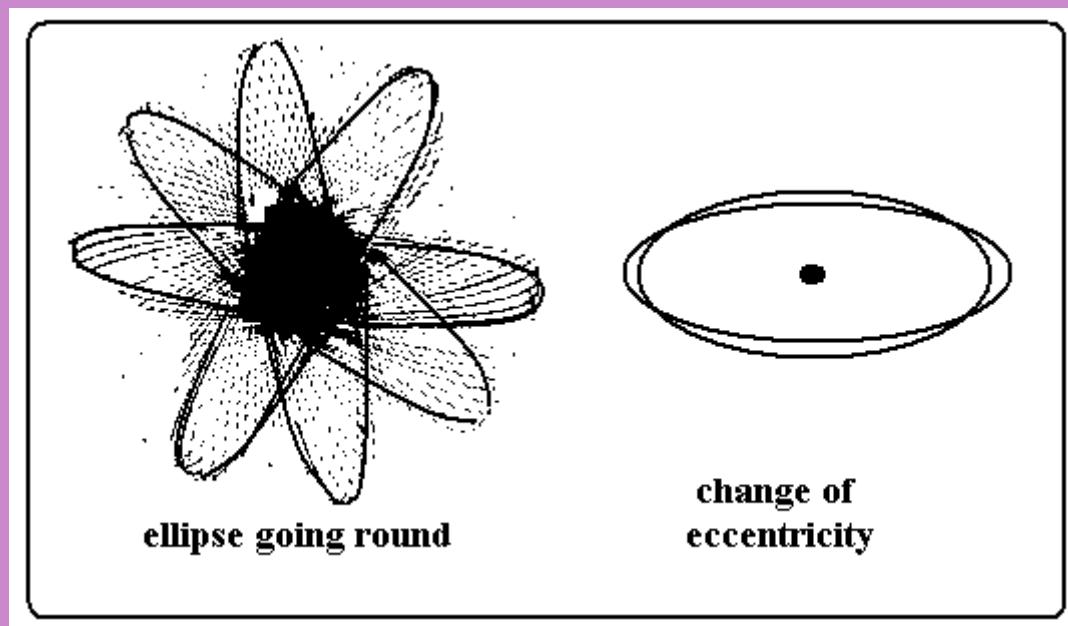
the climate at different places. But these axes are not constant, they change, because of gravitational effects, of the sun, moon and the planets. And this gradual change has brought about ups and downs in the earth's climate, over the ages.

The axes

The movement of the earth in its orbit follows the classic behavior of a child's top spinning under the effect of gravity. While spin at a good speed gives the top stability, so that it spins upright, forces of wind, obstructions or friction can cause 'rocking' of the axis of spin and also turning around of the axis of 'rock'!



And if the top were spinning not on a flat surface but inside a bowl, the whole top would also move around in a circle, or an ellipse, and the axis of this motion too would vary and turn, to describe a rosette shape.



The specific motions are *eccentricity*, *axial tilt* and *precession*. The first word means how oval the motion is, or how near and far from the sun the earth gets during different parts of the year. The earth, in fact moves nearly in a perfect circle, but still moves closer and farther in cycles of about 100,000 years and about 400,000 years.

The tilt is the angle between the axis of spin and the axis of motion around the sun. This is about 23.5 degrees at present but varies between 21.5 and 24.5 degrees, every 41,000 years. Precession is the rate at which these axes themselves go round in a circle, to describe a cone, and this has a time period of about 21,000 years.

These ups and downs also show periodicity in how far up and how far down, to an extent because they add or compensate, and also the effect of the other planets with which the earth shares the space around the sun. And these cycles have long periods, of eccentricity it is over 2.4 million years and of obliquity, over 1.2 million years.

Milutin Milankovich, a Serbian civil engineer and mathematician studied the periodicity of such movements of the earth, in its motion around the sun and developed a theory of corresponding variations in climate. The theory, however, is not accepted without question, because the main periodicity is of 100,000 years, but records of climate changes are considered not sufficient to establish a relationship. but the million year cycles of maxima and minima are associated with major glaciations, which have recently been partly established by geological evidence in deep ocean ice age records.

Rodent populations

Nature reports this week that a record of major climate changes on the earth is provided by the rise and fall of mammal populations over the ages. Scientists at Utrecht University, Holland, studied the records of fossils of rodent populations over a very long span of time, starting 24.5 million years ago. The records, of species types, abundance and antiquity, show that species showed a pattern of originating, flourishing and extinction turnover, peaking in two different cycles – one every 1.2 million years and the other every 2.5 million years.

The timing of these peaks correspond to events in the earth's behaviour – the 2.5 million year peaks happen when the earth gets closest to moving in a perfect circle and the 1 million year peak comes when the earth is turning round its degree of tilt. These are the events that also lead to growth of ice sheets and global cooling – which may be the reason for how long mammal species survive.
