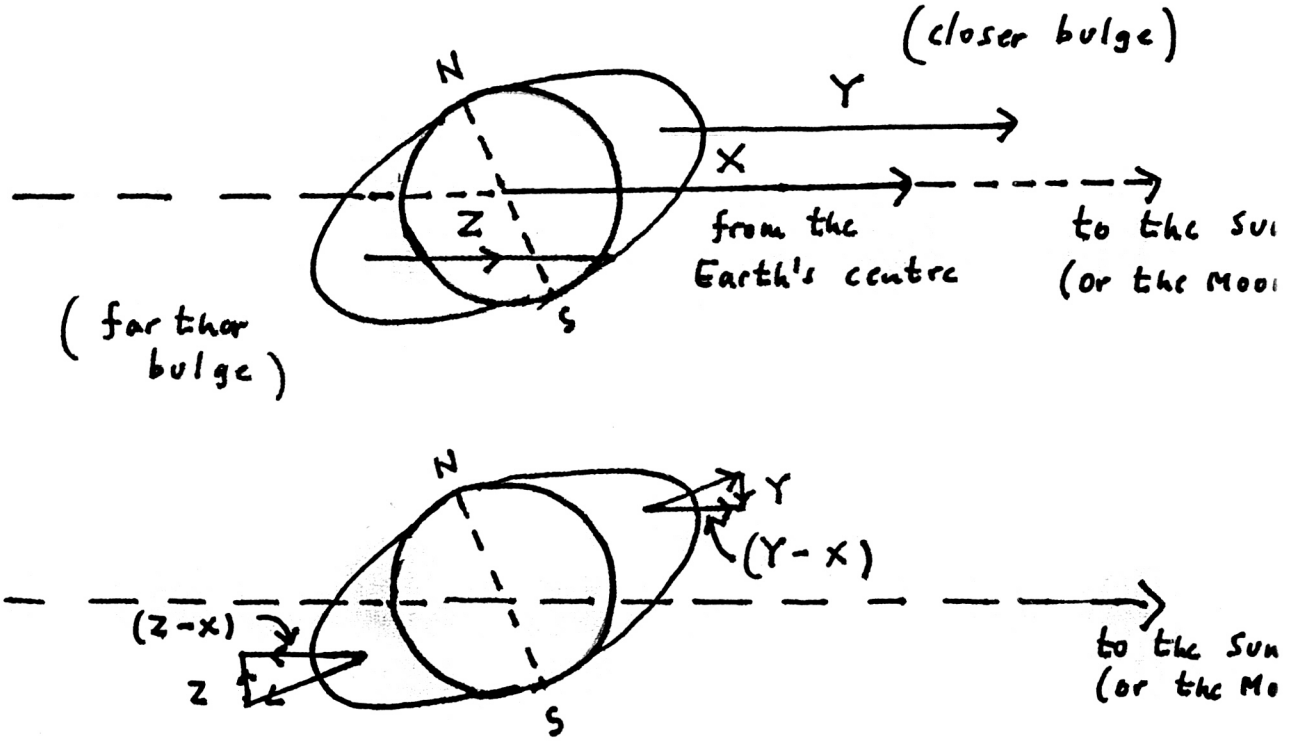
# Why does the Earth wobble?

The rotation of the Earth upon its axis has produced an equatorial bulge, and has caused the Earth to take the sha of an oblate spheroid, rather than a sphere. This oblateness is defined : oblateness = $\frac{\text{equatorial radius} - \text{polar radius}}{\text{equatorial radius}}$

For the Earth, oblateness = $\frac{6378.39\ \text{km} - 6356.91\ \text{km}}{6378.39\ \text{km}}$

$= \frac{1}{297}$




Attraction of the Sun (or the Moon) upon the oblate Earth. The attracti (accelerations) Y, X and Z are indicated as shown.

Since one-half of the bulge of the Earth is closer to the Su than the other, Y is larger than X, and Z is smaller than X In the lower diagram, the accelerations are referred to the cent of the Earth.

The two remaining accelerations, $(Y-X)$ and $(Z-X)$, ar resolved each into two components. The components, y and form a couple which tends to rotate the Earth.

The acceleration X, resulting from the force of attract of the Sun upon the sphere, lies in the plane of the eclipt the accelerations (Y, Z), resulting from the forces of attrac upon the two bulges, are slightly inclined to the ecliptic.

The upper diagram shows these three accelerations; Y is greater than X and X is greater than Z. If we subtract the vector X from the vectors Y and Z, we obtain the lower diagrams, in which the vectors (Y−X) and (Z−X) are nearly equal in magnitude, but <u>opposite in direction</u>.

Each of these two accelerations may be resolved into two components, one parallel to the equator, the other perpendicular to it (y, z). Both of these components, if operating alone, would tend to bring the Earth's equatorial plane in line with the ecliptic. The attraction of the Moon operates in the same way. Its orbital plane departs only 5° from the ecliptic. Hence, it tends to reorient the bulge of the Earth and bring it into coincidence with the plane of its own orbit.

The accelerations resulting from the Moon (much less massive than the Sun) are nevertheless important, because the Moon is only $\left(\frac{1}{400}\right)$ of the Solar distance

This realignment is never attained, because the Earth is spinning on its axis (rotating). A force acting upon a rotating object does not produce the same results as a force acting upon a non-rotating object.

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