Answer on question #53476, Physics / Mechanics — Kinematics — Dynamics

Question Calculate the kinetic energy of Earth due to its spinning about its axis, and compare your answer with the kinetic energy of the orbital motion of Earth's center of mass about the Sun. Assume Earth to be a homogeneous sphere of mass $6.0 \cdot 10^{24}$ kg and radius $6.4 \cdot 10^{6}$ m. The radius of Earth's orbit is $1.5 \cdot 10^{11}$ m. (Moment of inertia for a sphere $I = 2/5MR^2$).

Solution Kinetic energy of the spinning is

$$E_s = \frac{Iw_{day}^2}{2} = \frac{MR^2 w_{day}^2}{5} = \frac{6.0 \cdot 10^{24} \cdot (1.5 \cdot 10^{11})^2 \cdot 1/(86400)^2}{5} \approx 3.6 \cdot 10^{36}\ J$$

Kinetic energy of the orbital motion is

$$E_o = \frac{mv^2}{2} = \frac{mw_{year}^2 r^2}{2} = \frac{6 \cdot 10^{24} \cdot 1/(31000000)^2 \cdot (150 \cdot 10^{9})^2}{2} \approx 7.0 \cdot 10^{31}\ J$$

As we can see, kinetic energy of spinning is much bigger.