21-P-MOM-AG-048

The sun, which has a mass of $1.989 \cdot 10^{30}\ kg$, is orbiting the center of the Milky Way galaxy at a radius of 26,000 light years ($245.979 \cdot 10^{15}\ km$) and at a speed of $240\ \frac{km}{s}$. What is the angular momentum of the sun orbiting the center of the galaxy? If, at some point in the next millenia, humanity invents a stellar engine that can impart *F* Newtons of force on our sun for X years straight to move it further along the normal path out of the way of a massive asteroid shower, how much angular impulse will we impart on the sun?

ANSWER:

First, we write down the equation for angular momentum and input our known values.

$$\left(\vec{H}_O\right) = m \cdot r \times v = mass \cdot radius\ \hat{r} \cdot speed\ \hat{\varphi} = mass \cdot radius \cdot speed\ \hat{k}$$

Then, we write down the equation for angular impulse and input our known values.

$$\sum \int_{t_1}^{t_2} M_z\ dt = \int_0^{X \cdot 365 \frac{days}{year} \cdot 24 \frac{hours}{day} \cdot 60 \frac{minutes}{hou} \cdot 60 \frac{seconds}{minute}} (r \times F)\ dt$$

$$= \int_0^{X'} (radius\ \hat{r} \cdot force\ \hat{\varphi})\ dt$$

$$= X' \cdot radius \cdot force\ \hat{k}$$