

Answer the following questions for the two body Sun-Earth system. Assume that the forces due to all other heavenly bodies can be neglected. Use \vec{r}_1, \vec{r}_2 to denote positions, and \vec{p}_1, \vec{p}_2 to denote the momenta of the Sun and the Earth, respectively. Check if the quantities listed below are conserved.

- [1] The sum of angular momenta of the Sun and the Earth
- [2] The sum of momenta of the Sun and the Earth
- [3] The angular momentum $\vec{r} \times \vec{p}$ where $\vec{r} = \vec{r}_2 - \vec{r}_1$ is the position of the earth relative to the Sun. and $\vec{p} = \mu \vec{v}$ where μ is the reduced mass and \vec{v} is the velocity of the Earth relative to the Sun.
- [4] Write approximation, if any, under which the angular momentum of the earth will be a constant of motion.

Using Newtonian mechanics only, give brief arguments in support of your answer.