Klassische Teilchen und Felder

Präsenzübung, Blatt 03 **WS 08/09 29.10.2008**

Vorlesung: Luis Santos – Übungen: Garu Gebreyesus & Tobias Wirth

[P6] Inertial tensor of a quadratic disk

a) Calculate the inertial tensor $I_{(S)}$ of a homogeneous quadratic infinitesimal thin disk with edge length ℓ and mass m relative to its center of mass S in an appropriate principal axis system.

b) Now move the center of rotation in a corner E of the disk and calculate the resulting inertial tensor $I_{(E)}$ in principal axis form.

Hint: Use the symmetry of the disk to choose the principal axis system in S as simple as possible. Use the parallel-axes theorem (Steiner's theorem).

[P7] Runge-Lenz vector

Besides the energy E and the three angular momentum components L_j with respect to the center of mass, which are conserved for any movement of a mass in any central force potential, there is another independent conserved quantity for the Kepler's problem, $V(r) = -\alpha/r, \alpha > 0$.

a) Show that the Runge-Lenz vector,

$$\vec{M} \equiv \vec{v} \times \vec{L} - \alpha \vec{e}_r$$

is a conserved quantity.

b) Show that $\vec{L} \cdot \vec{M} = 0$, $\vec{M} \parallel \vec{r}$ at any time, and $\vec{M} \cdot \vec{e}_r = \frac{L^2}{mr} - \alpha$.

Abgabe der Ausarbeitungen der Hausübungen ist Dienstags <u>VOR</u> der Vorlesung, d.h. bis <u>08:15 Uhr</u>. Eine spätere Abgabe ist nicht möglich!