Klassische Teilchen und Felder
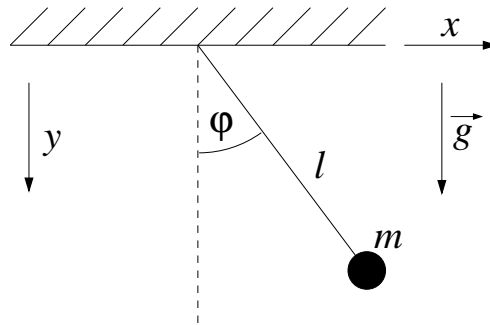
Vorlesung: Luis Santos – Übungen: Garu Gebreyesus & Tobias Wirth

[P14] pendulum swinging

A pendulum with constant string length l and mass m swings under the influence of the gravitational field of the earth (see figure).

a) What is the Hamilton function?

b) Derive the Hamilton equations and find an equation for $\ddot{\varphi}$ with them.

[P15] Poisson brackets of the angular momentum

Let $\vec{q} = (q_x, q_y, q_z)$ be the Cartesian coordinates of a particle and $\vec{p} = (p_x, p_y, p_z)$ its corresponding momenta. Furthermore let $\vec{L} = \vec{q} \times \vec{p}$.

a) Calculate $\{L_z, q_k\}$ and $\{L_z, p_k\}$ each with $k \in \{x, y, z\}$

b) Calculate $\{L_x, L_y\}$, $\{L_x, L_z\}$, $\{L_y, L_z\}$ and express the results as a function of the components of the angular momentum.

[P16] canonical transformations

Let $\{p, q\}$ be canonical conjugated variables.

a) Check if

$$\left\{ \begin{array}{l} Q = \ln(1 + \sqrt{q}\cos p) \\ P = 2(q + \sqrt{q}\cos p)\sqrt{q}\sin p \end{array} \right\}$$

is a canonical transformation.

b) Given

$$\left\{ \begin{array}{l} Q = q^\alpha \cos \beta p \\ P = q^\alpha \sin \beta p \end{array} \right\} \quad \text{with } \alpha, \beta \text{ constants,}$$

determine for what values of α and β this transformation is canonical.

Meldungszeitraum für Bachelorstudiengang beachten: 12.-28. November!

Anmeldungen für die mündlichen Prüfungen möglich bei Fr. Schwebs (Appelstr. 2, nördlich gegenüber Raum 269).