Universität Leipzig, Fakultät für Physik und Geowissenschaften

Exercises for Experimental Physics 1 – IPSP

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Exercise Sheet 8 (WS 2013/14)

Date of Issue: Dec. 6^{th} 2013

Date of Submission: Dec. 13^{th} 2013

Submission Place: Marked mailbox next to room 302 (Linnestr. 5)
Submission Time: 11:00 a.m. at the submission day noted above

Please note: Write your name and matriculation number on EACH sheet of paper. Only submit the calculations and results for exercise 1-3, exercise 4 will be discussed during the seminar.

Exercises:

1. Use integration to determine the moment of inertia about its axis of a uniform right circular cone of height H, base radius R, and mass M (see Fig. 1) (7 Points)

2. A uniform rectangular plate has mass m and edges of lengths a and b. (a) Show by integration that the moment of inertia of the plate about an axis that is perpendicular to the plate and passes through one corner is $m(a^2 + b^2)/3$. (b) What is the moment of inertia about an axis that is perpendicular to the plate and passes through its center of mass? (7 Points)

3. 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. (6 Points)

4. A uniform 1.5-m-diameter ring is pivoted at a point on its perimeter so that it is free to rotate about a horizontal axis that is perpendicular to the plane of the ring. The ring is released with the center of the ring at the same height as the axis (Fig. 2). (a) If the ring was released from rest, what was its maximum angular speed? (b) What minimum angular speed must it be given at release if it is to rotate a full 360°?

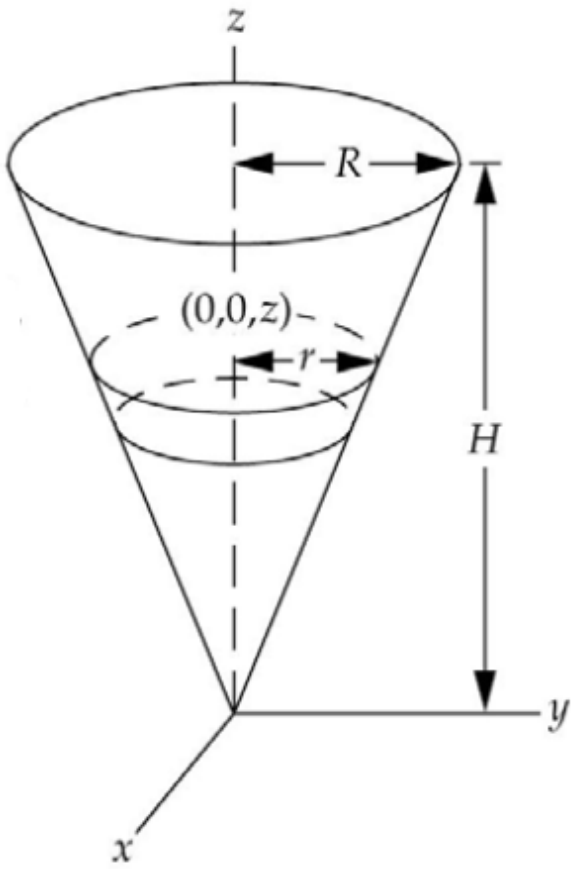

Figure 1: Exercise 1

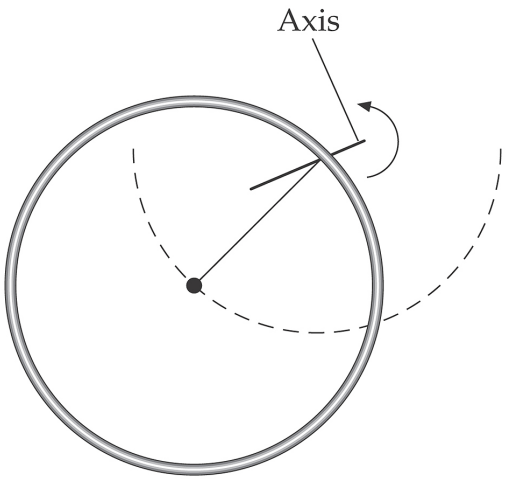

Figure 2: Exercise 4