Exercises for Experimental Physics 2 – IPSP

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Exercise Sheet 10 (SoSe 2012)

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Date of Submission: June 22nd 2012

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 instruction classes.

Exercises:

1. What is the equivalent capacitance (in terms of C which is the capacitance of one of the capacitors) of the infinite ladder of capacitors shown in Figure 1? (5 Points)

2. Calculate the electric potential at the point a distance $R/2$ from the center of a uniformly charged thin spherical shell of radius R and charge Q. (Assume the potential is zero far from the shell.) (6 Points)

3. An infinitely long nonconducting solid cylinder of radius a has a non-uniform volume charge density. This density varies linearly with R, the perpendicular distance from its axis, according to $\rho(R) = \beta R$, where β is a constant. (a) Show that the linear charge density of the cylinder is given by $\lambda = 2\pi\beta a^3/3$. (b) Find expressions for the electric field for $R < a$ and $R > a$. (9 Points)

4. A circle of radius a is removed from the center of a uniformly charged thin circular disk of radius b and charge per unit area σ. (a) Find an expression for the potential on the x axis a distance x from the center of the disk. (b) Show that for $x \gg b$ the electric potential on the axis of the uniformly charged disk with cutout approaches kQ/x, where $Q = \sigma\pi(b^2 - a^2)$ is the total charge on the disk.
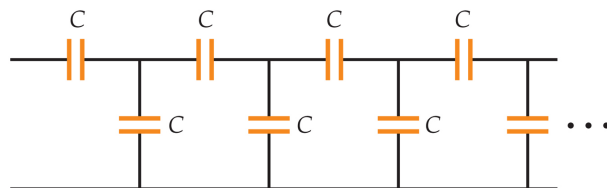

Figure 1: Exercise 1