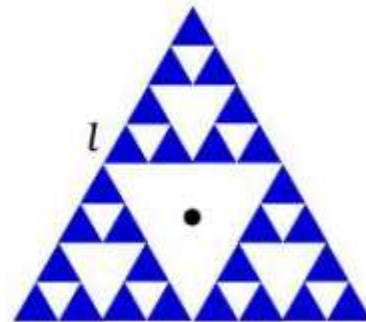


## METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH zima22 – Príklady 1

Cvičenie 22.9.2022

### Príklad 1

Take an equilateral triangle of side  $\ell$ , and remove the middle triangle ( $1/4$  of the area). Then remove the middle triangle from each of the remaining three triangles (as shown), and so on, forever. Let the final object have mass  $M$ . Find the moment of inertia of this object, around an axis through its center and perpendicular to its plane.

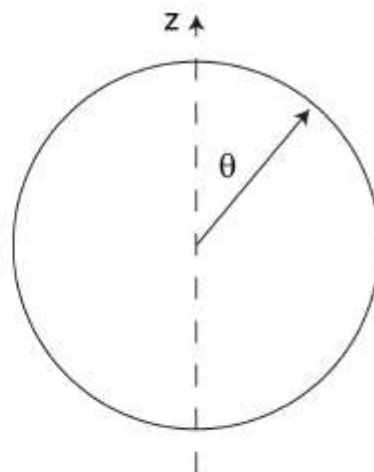


### Príklad 2

Consider a sphere of radius  $R$ . The potential on the surface of the sphere varies as (see figure below)

$$\phi(\theta) = \phi_0 \cos^2 \theta$$

The region inside and outside the sphere is empty.



- Compute the potential inside and outside of the sphere.
- Compute the electric field inside the sphere.
- Using Gauss' law, show that while the electric field inside the sphere is non-zero, no charge is contained inside the sphere.

### Príklad 3

**PROBLEM:** A long, straight cylindrical wire, of radius  $a$  carries a uniformly distributed current  $I$ . It emits an electron from  $r = a$ , with initial, relativistic velocity  $v_0$  parallel to its axis. Find the maximum distance  $r_{max}$  from the axis of the wire which the electrons can reach, treating everything relativistically.

#### Příklad 4

A very long wire of radius  $a$  is suspended a distance  $d$  above an infinite conducting plane. In the case that  $d \gg a$ , find approximate expressions for

- The capacitance per unit length of the wire, conducting plane system.
- The surface charge density on the conducting plane as a function of  $y$ , the distance along the plane lateral to the wire.

