

Electromagnetic Theory II

HW #2 (10 points)

Due: 1-15-2016

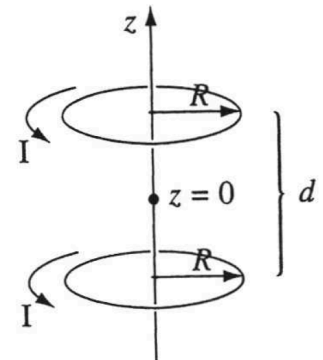
1. A DJ's turntable has radius R and carries a uniform surface charge σ (the plastic turntable was rubbed with a fleece sweater). It rotates at constant angular velocity ω . We choose the z -axis to be perpendicular to the surface and pass through the center of the turntable. Find B everywhere on the z -axis.



2. The magnetic field on the axis of a circular current loop is far from uniform (it falls off sharply with increasing z). You can produce a more nearly uniform field by using two such loops a distance d apart.

(a) Find the field (B) as a function of z , and show that $\partial B/\partial z$ is zero at the point midway between them.

(b) If you pick d just right, the second derivative of B with respect to z will also vanish at the mid-point. This arrangement is known as a Helmholtz coil and is often used in experiments. Determine d and find the resulting magnetic field at the center.



3. A sphere of radius a carries a uniform surface charge σ . The sphere rotates with constant angular velocity ω about an axis that passes through the middle of the sphere. Find the magnetic field \mathbf{B} both inside and outside the sphere.

You can approach this problem by first calculating vector potential, \mathbf{A} , or directly calculating magnetic field \mathbf{B} .