

**The Magnetic Vector Potential Due to a Spinning Ring of Charge**

1. Use the superposition principle for the magnetic vector potential due to a continuous current distribution:

$$\vec{A}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{\vec{J}'(\vec{r}')}{|\vec{r} - \vec{r}'|} d\tau', \quad (1)$$

to find the magnetic vector potential everywhere in space due to a spinning charged ring with radius  $R$ , total charge  $Q$ , and period  $T$ .

2. Evaluate your expression for the special case that  $\vec{r}$  is on the  $z$ -axis.
3. Evaluate your expression for the special case that  $\vec{r}$  is on the  $x$ -axis.
4. Find a series expansion for the electrostatic potential at these special locations:
  - a) Near the center of the ring, in the plane of the ring;
  - b) Near the center of the ring, on the axis of the ring;
  - c) Far from the ring on the axis of symmetry;
  - d) Far from the ring, in the plane of the ring.