

PHYS 704 - Test 2.

- 1. [8 points] A current of amplitude 1 A and frequency 100 MHz flows through a circular loop of diameter 1 m. Find the total power radiated (in W) and the radiation resistance of the antenna (in ohms). What is the direction of the polarization of the radiation at a point in the plane of the loop but thousands of radii away?
- 2. [4 points] Radar is reflected off rain. Assume that a raindrop is a sphere of radius a , small compared to the wavelength of radar, and has a frequency-independent dielectric constant ϵ . What is the dependence of the radar echo intensity on the raindrop size a , the radar frequency ω , and the distance R of the rainfall region from the radar station (which radiates and then receives the echo). [*Derivations and explanations can be kept to a minimum.*]
- 3. [8 points] Use the Lorentz transformation to derive length contraction and time dilation. **An explanation of what you are doing, in each reference frame, is critical.** *Correct equations without complete explanations will not receive significant credit.*