**Department of Physics**
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Quantum Universe (4E)
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Quiz # 1 (April 11 2005)

Problem 1 : A Mass Spectrometer   [10 pts]

The mass spectrometer shown in the figure below separates ions having the same velocity. The ions after entering through slits S_1 and S_2 pass through a velocity selector composed of an electric field **E** produced by charged plates P and P', and a magnetic field **B** perpendicular to the ion path. The ions that then pass undeviated through the crossed **E** and **B** fields enter into a region where a second magnetic field B' exists, where they are made to follow circular path. A photographic plate registers their arrival. The radius of the circular paths is measured to be R. (a) Write an expression for the velocity of the ions that pass through the velocity selector undeviated (b) Find the expression for q/m for these ions in terms of the radius R, the electric field **E** and magnetic fields **B** and **B'**.
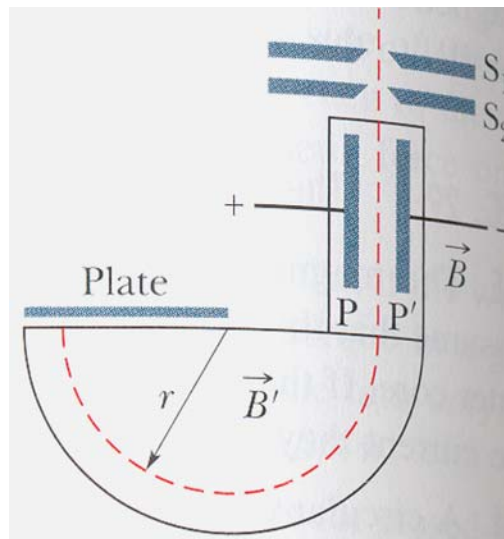
Problem 2: Quantum Pool Anyone ?   [10 pts]

An electron moving to the left at 0.8c collides with an incoming photon moving to the right. After the collision, the electron is moving to the right at 0.6c and the scattered photon moves to the left. (a) Sketch this process (b) Write down the conservation equations. (c) What was the wavelength (in meters) of the incoming photon?

Please consult the proctor if you don't understand any part of the questions