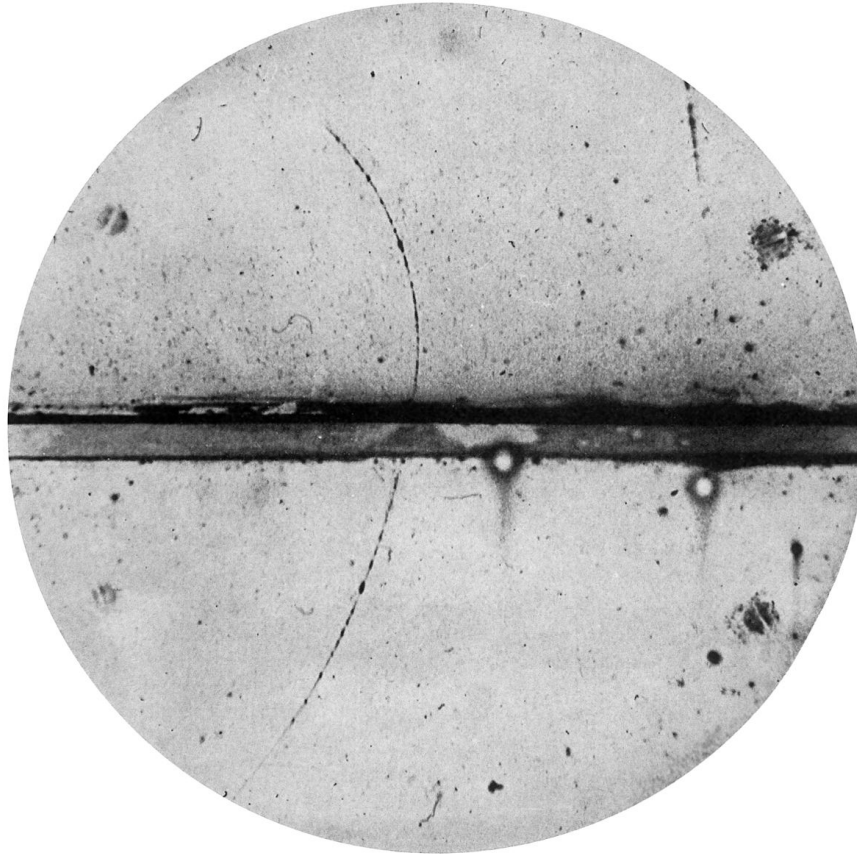


PHY4000W Nuclear Physics

Laboratory 1

The below image shows the cloud chamber photograph taken by Carl Anderson of the first identified positron track, including other features [1]. A high-resolution copy of the image is available for download from Vula.



A 6 mm lead plate separates the upper half of the chamber from the lower half (the dark horizontal band in the image). Assume that the positron motion is constrained to the plane of the image (i.e. there is no parallax or depth correction required).

Your task is to write this experiment up as if you had measured these data in the laboratory, using a typical laboratory report style. You should include a discussion about the context of the experiment, what the equipment measures and how. You should lead the discussion to the determination of the above track being due to a positron and measure its charge to mass ratio. You should compare the stopping power of this particle to that for electrons with the same momenta. Be sure to address the below questions in your report, which has a 4 page limit.

Questions:

1. Identify the particle track of interest.
2. Does the particle track enter the chamber from the top or from the bottom?
State as many reasons you can think of for how you know this.
3. Given that the track has been identified as due to a positron, in which direction (relative to the image) is the applied magnetic field?
4. How might the fact that it has been identified as a positron be calibrated for (i.e. given that this is the first ever positron identified, how might you assume this)?
5. Use a graphical method (computational or otherwise) to measure the radii of curvature of the positron track on entry and on exit. This should be the main focus of your report, i.e. *your* experimental methods and analyses.
6. The externally applied magnetic field was 1.5 Tesla. What was the positron momentum (in MeV/c) when it entered the chamber, and when it left the chamber?
7. What is the approximate stopping power of lead for an electron of this energy?

Administration:

Released Thursday 4 August, due on or before Friday 19 August.

Submissions should be a single file, uploaded to the appropriate place on Vula.

Reference:

[1] Anderson, C. (1933). "The positive electron", Physical Review 43 (6): 491. (also available on Vula)