Lab #5 notes:

- Don't blindly trust What is stamped/labeled - use your trusty multi-meter
- Measurements w/multi-meter worked better for me when components were *not* in the breadboard
- if doing a *charging* capacitor, remember to discharge at start of trial
- no need to wait until fully charged or discharged for the exponential curve (theoretically takes ∞ time)
- try to get RC time constants that are more like 1-20 sec (vs 0.001 s or 1,000 s)
- for the write-up, compute 3 separate % "errors" along with their "uncertainties" via $\sigma/\sqrt{3}$. And then give me your average % error (no uncertainty on that needed)

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ch 11 Magnetism

- Earth's B field at the surface is ~0.5 Gauss

sl.html shows how Earth's "B field" changes its orientation over time

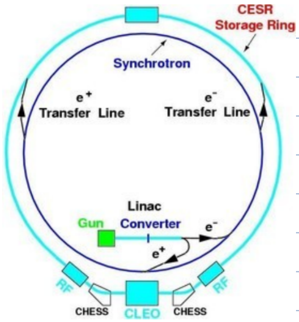
- B fields caused by moving charges
- B fields are 3D: not only do your iron filings map out big 2D loops on your paper, they also loop around "above" and "below" your paper

oscilloscope + *magnet demo*

$\vec{F}_{mag} = q\vec{v} \times \vec{B}$ force perpendicular to both $\vec{v}$ and $\vec{B}$

Cornell e^- storage ring example: please compute the e^- speed from ch11/sl.html

The Cornell Electron Storage Ring is located in a circular tunnel under some intramural fields at Cornell U. There are two concentric rings in the tunnel – the synchrotron, which accelerates electrons and positrons, and the outer storage ring, where the two kinds of particles counter-circulate before colliding and annihilating.

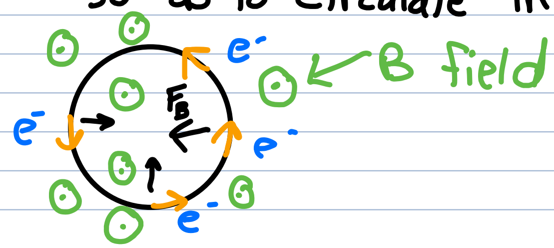


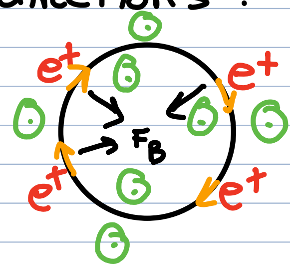
$v = \frac{dist}{time} = \frac{2\pi r}{1/f}$

$\approx 0.999\ c$

2π * radius: 768 m
circular frequency: 390 kHz
400 magnets

Q: why are the e^- and e^+ bunches steered into the synchrotron so as to circulate in opposite directions?





$\vec{F} = q\vec{v} \times \vec{B}$ in both cases yields inward forces ✓ need that for centripetal acceleration

A: the same $\vec{B}$ field sends them in oppositely-directed loops

Q: What is the $\vec{B}$ magnitude?

A: $\vec{F} = q\vec{v} \times \vec{B} = \frac{mv^2}{R}(-\hat{r}) \Rightarrow qvB\,\cancel{\sin\theta}\,(-\hat{r}) = \frac{mv^2}{R}(-\hat{r})$

$\rightarrow B = \frac{mv}{qR} = 0.16\,T$