

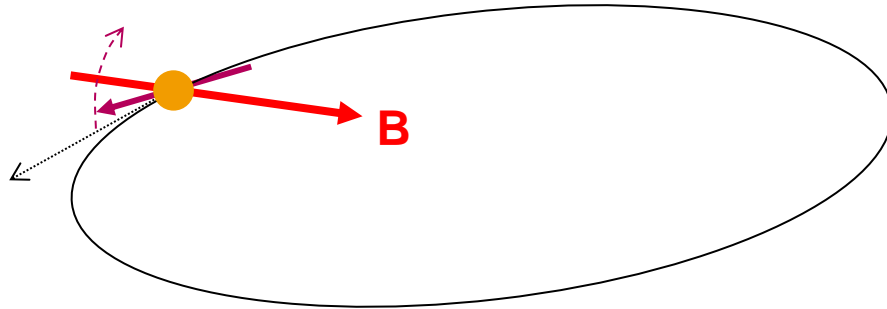
Part 2

Ring Systematic Errors, Requirements

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An EDM-like precession may come from a transverse magnetic field.



Proton case:

To stay below 10^{-29} e·cm,
 $\mathbf{B} < 3 \times 10^{-13}$ gauss.

Things that help:

If the orbit is stable,

$$\oint B_R ds = 0$$

This assumes no other forces are present.

Where does gravity start to matter?

For magnetic focusing, gravity is balanced by

$$\omega = G \frac{g}{v}$$

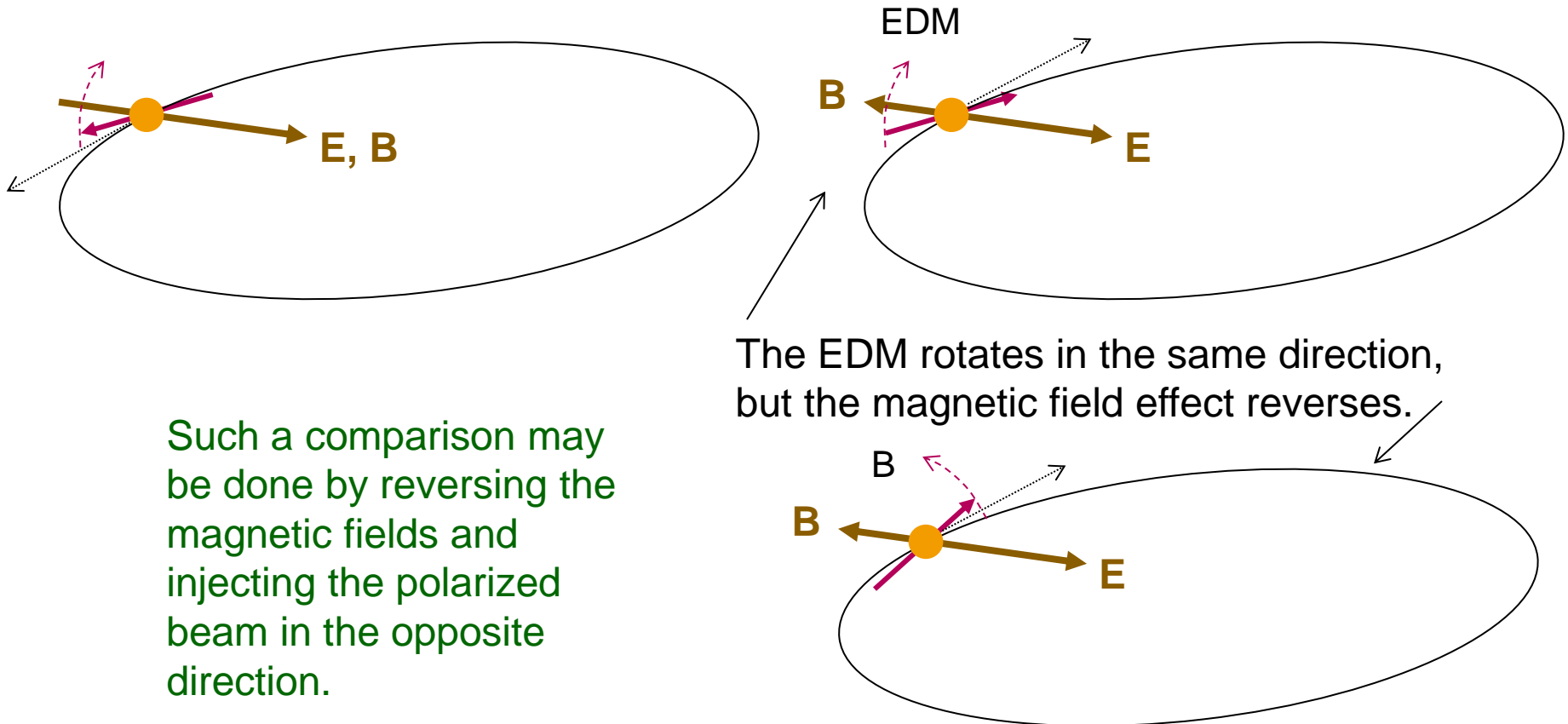
acceleration
due to gravity

particle
velocity

$\omega = 9.8 \times 10^{-8}$ /s, equivalently an EDM of 1.9×10^{-28} e·cm

We need additional tools to deal with this.

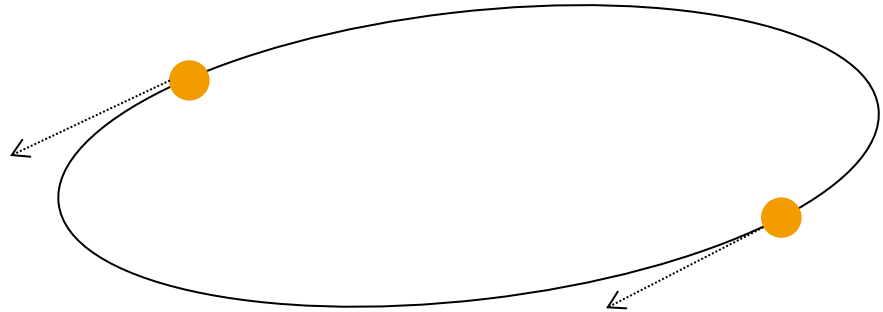
Consider counter-rotating beams, one is time-reverse of the other.
In time reversal, \mathbf{v} , \mathbf{B} , and spin all flip. \mathbf{E} does not.



Proton case:

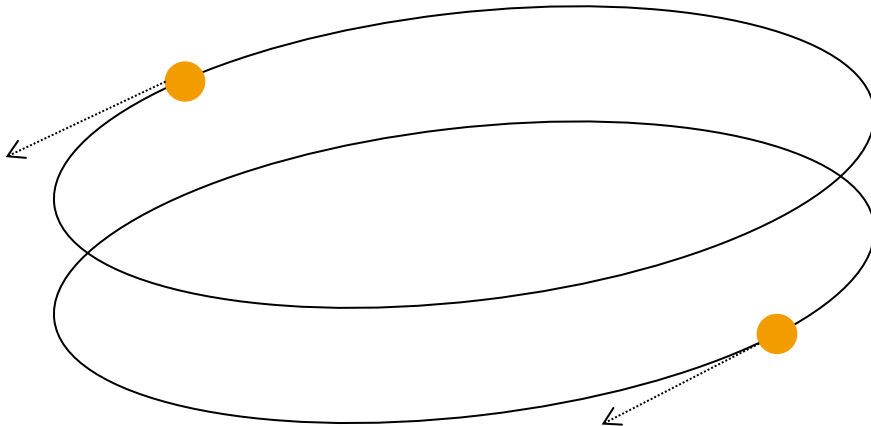
In electric ring, beams may counter-rotate at the same time.

Any radial **B** field causes the beams to separate, an error that may be seen on beam position monitors.



Deuteron case:

With electric and magnetic fields, two beams must run in separate tracks with opposite **B**. Like a single ring, the comparison must involve reversing both rings and repeating the experiment. Some elements (**E** plates) may be constructed in common.



Feasibility Requirements

1 POLARIMETER

The sensitivity to polarization must be large (0.5).

The efficiency of using the beam must be high (> 1%).

Systematic errors must be managed (< 10^{-6}).

2 POLARIZED BEAM

Polarization must last a long time (> 1000 s).

Polarization must remain parallel to velocity.

3 ELECTRIC FIELD, as large as practical (no sparks).

4 PROTON BEAM POSITION MONITORS

5 SYSTEMATIC ERROR PLAN