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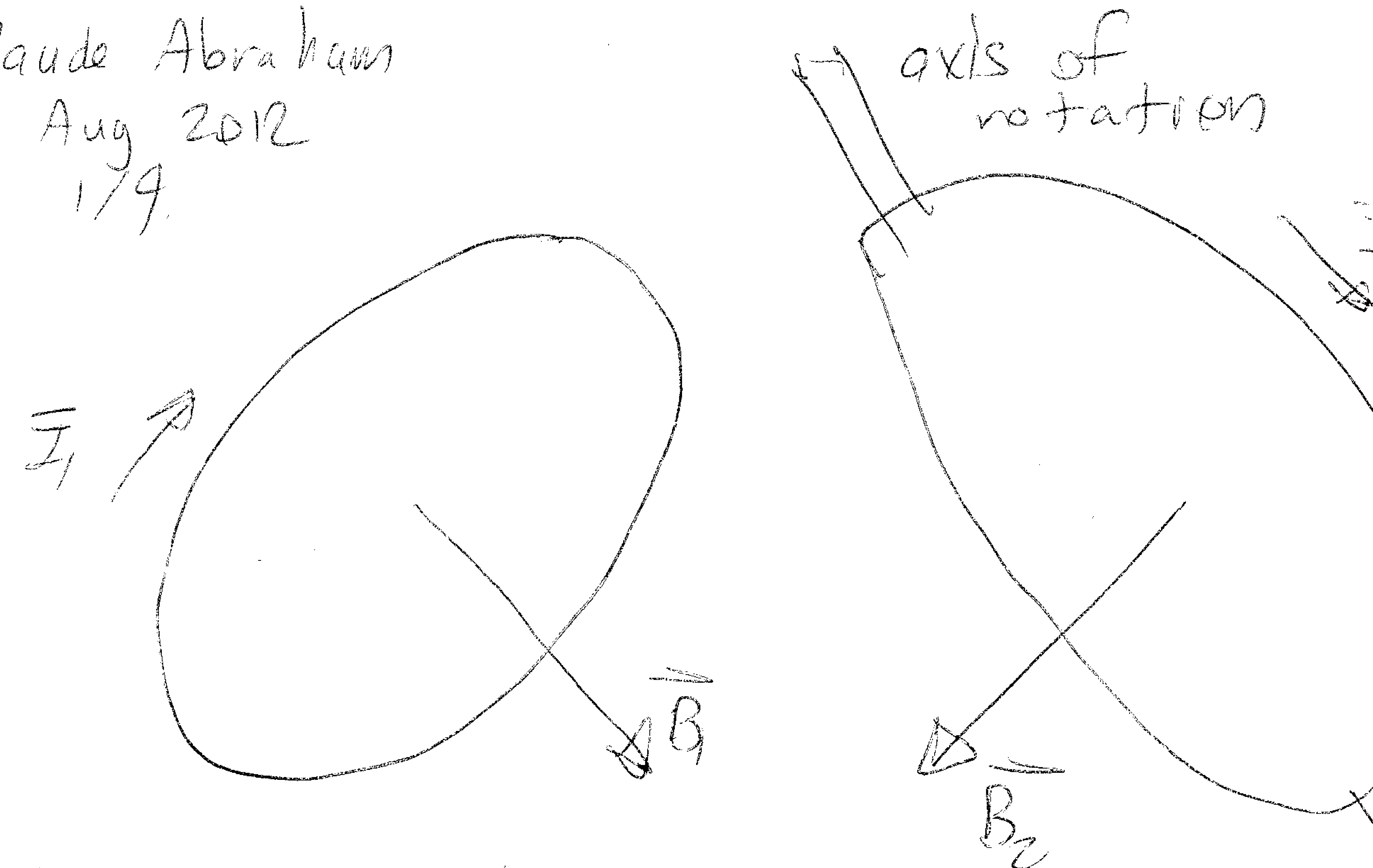
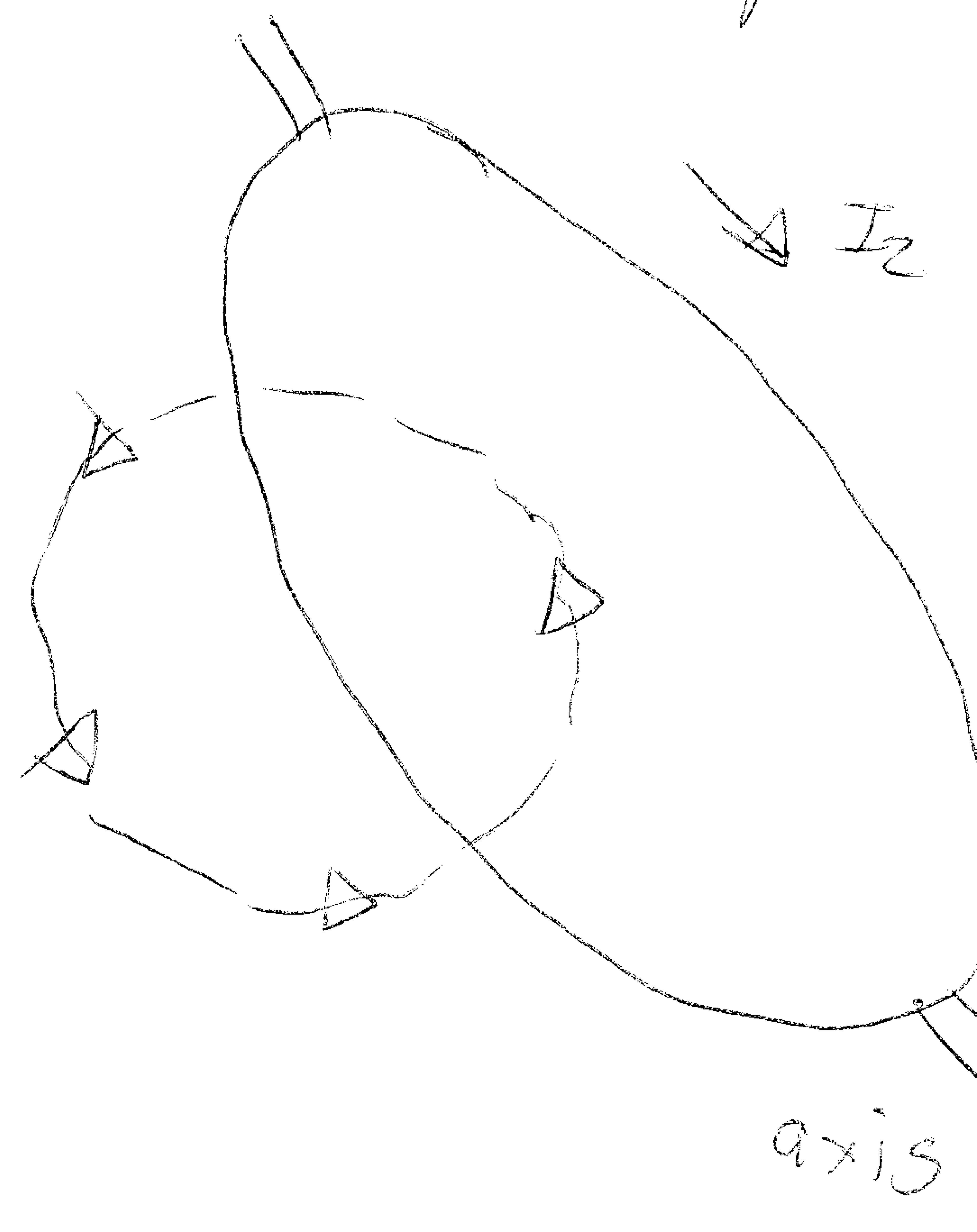


The 2 loops are oblique with an angle of 45° between them.

We will examine an isolated view of loop 2

$\vec{B}_1$ flux cuts loop 2 obliquely at 45° angle. We can resolve $\bar{B}_1$ into $\bar{B}_{1P}$ which is parallel to the loop 2 plane, plus $\bar{B}_{1n}$, which is normal to the loop 2 plane



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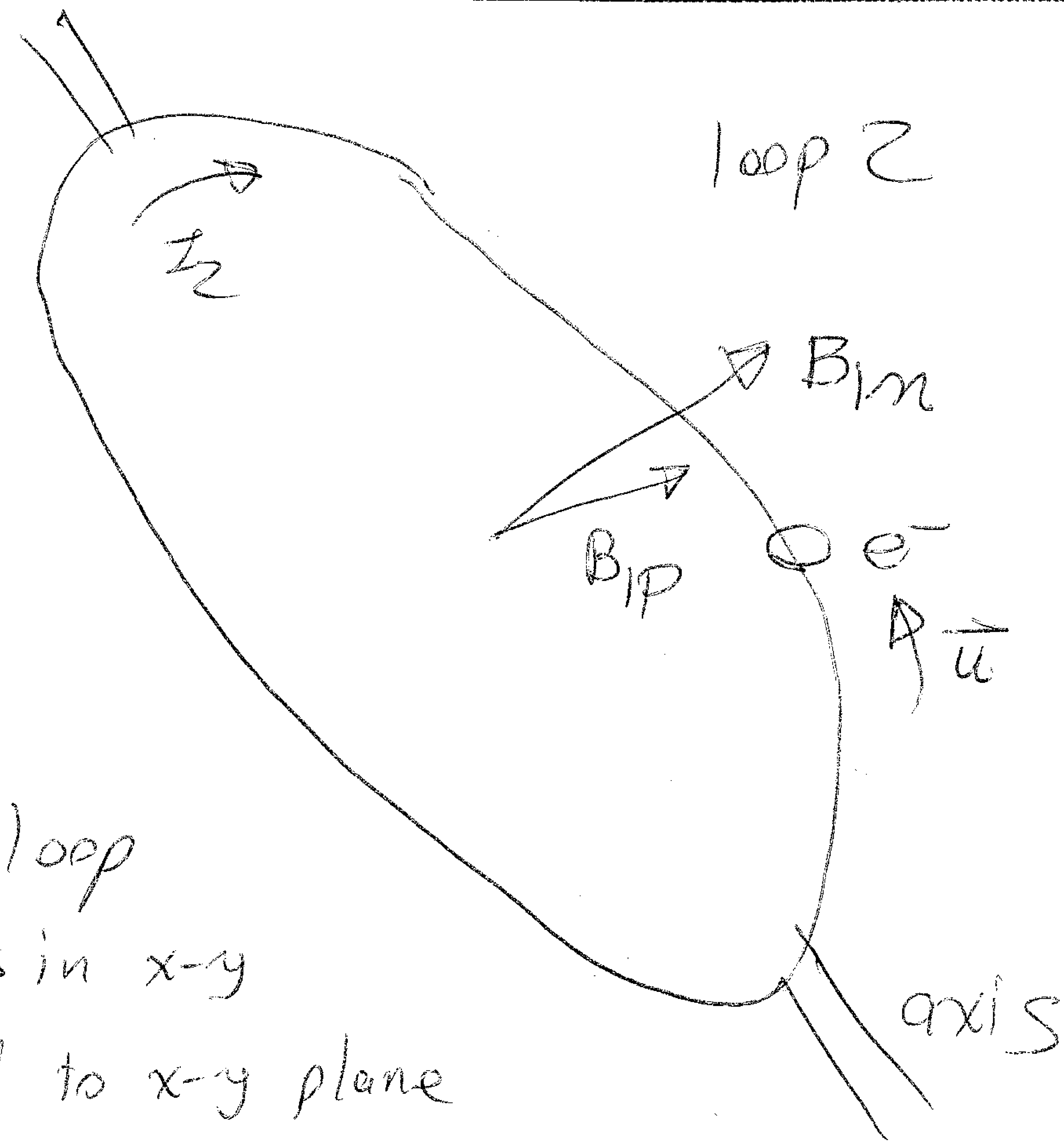
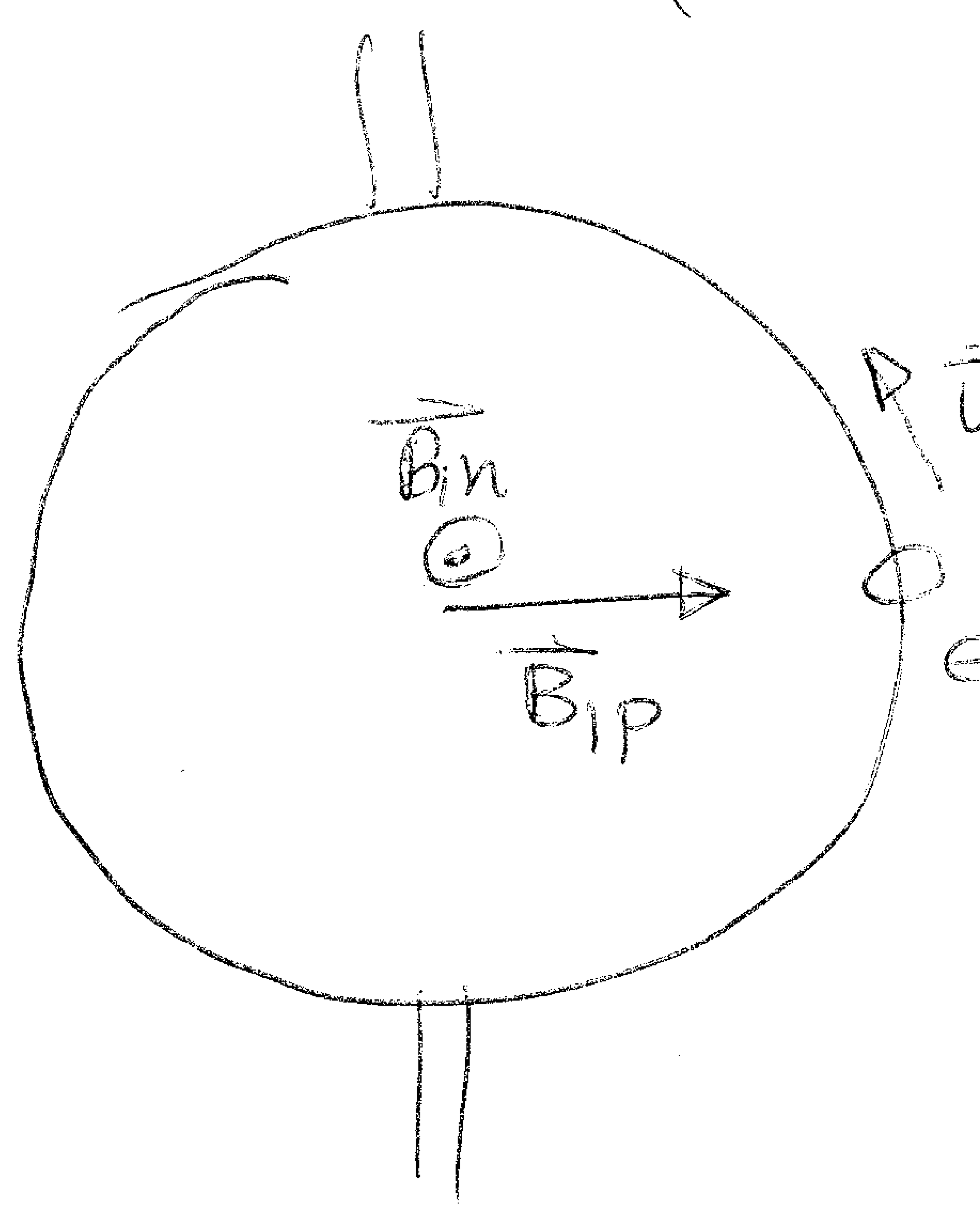


An e^- on the loop 2 has a velocity $\vec{u}$, subject to B_{1n} & B_{1p}

If the plane of the loop is x-y plane, B_{1p} is in x-y plane, B_{1n} is normal to x-y plane & is along z direction.

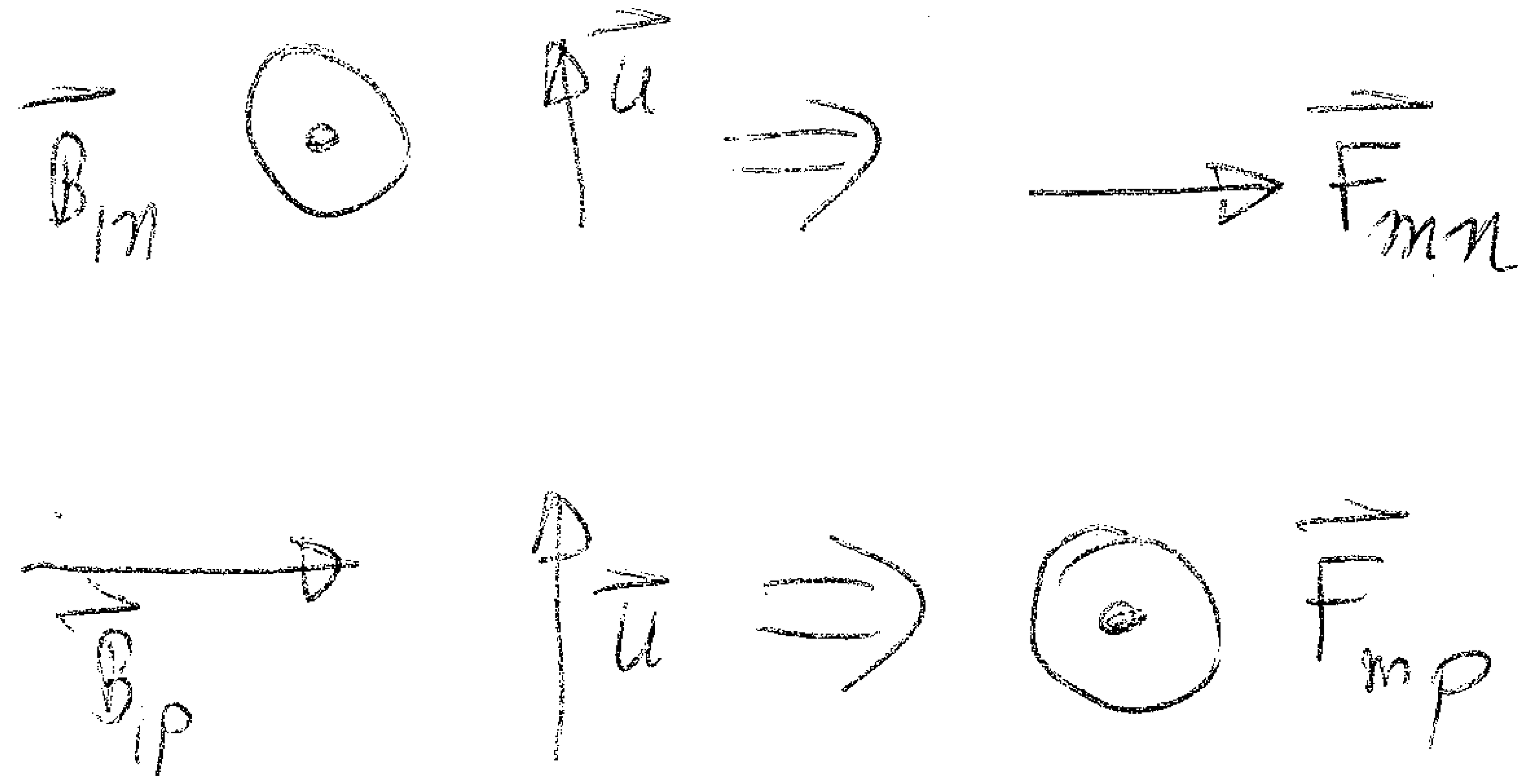
Looking down onto x-y plane ;

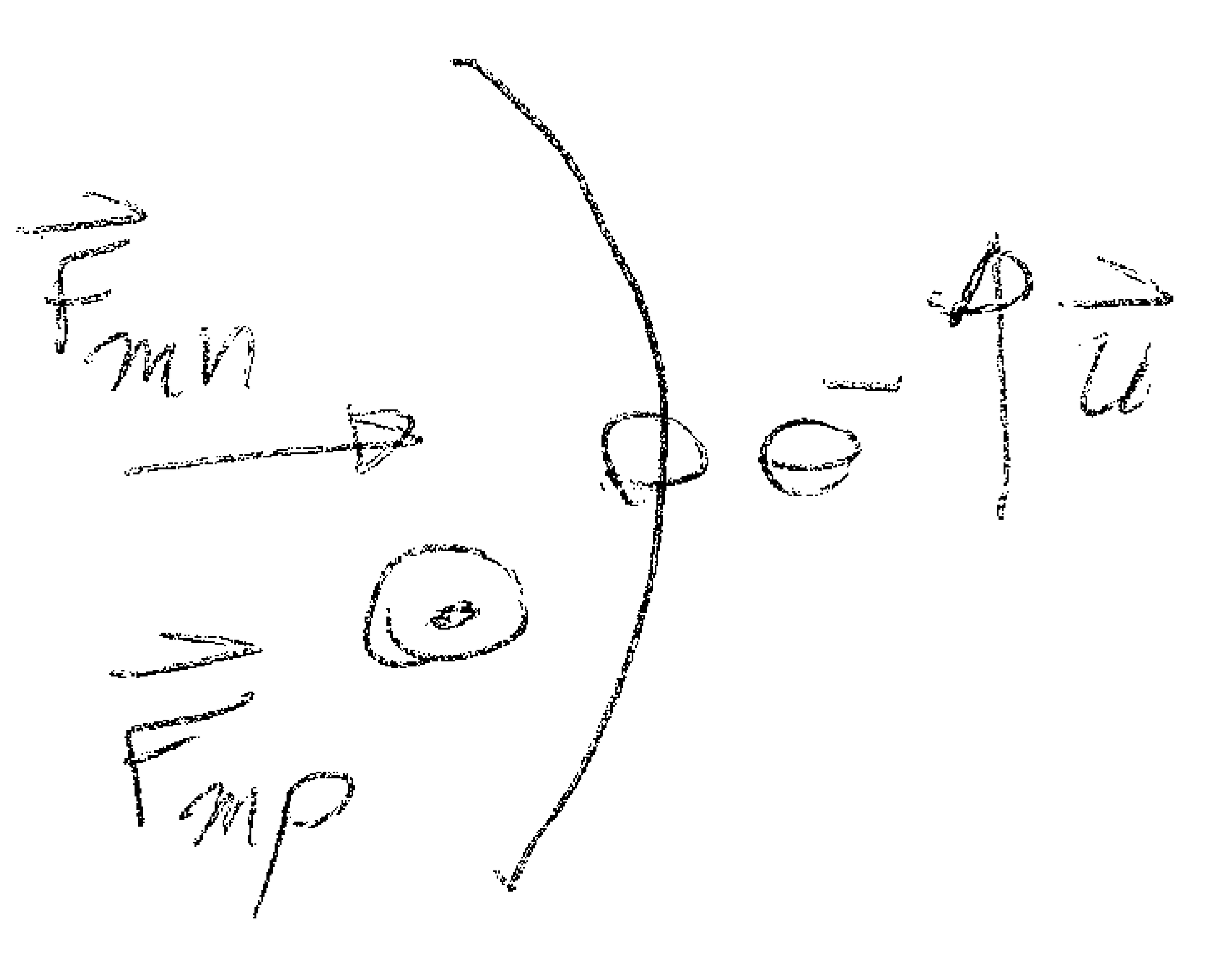


The Lorentz force on the e^- :

$\vec{F} = \vec{F}_e + \vec{F}_m$ where $F_e = q\vec{E}$, $\vec{F}_m = q(\vec{u} \times \vec{B})$

$\vec{F}_m = q(\vec{u} \times (\vec{B}_{1n} + \vec{B}_{1p}))$





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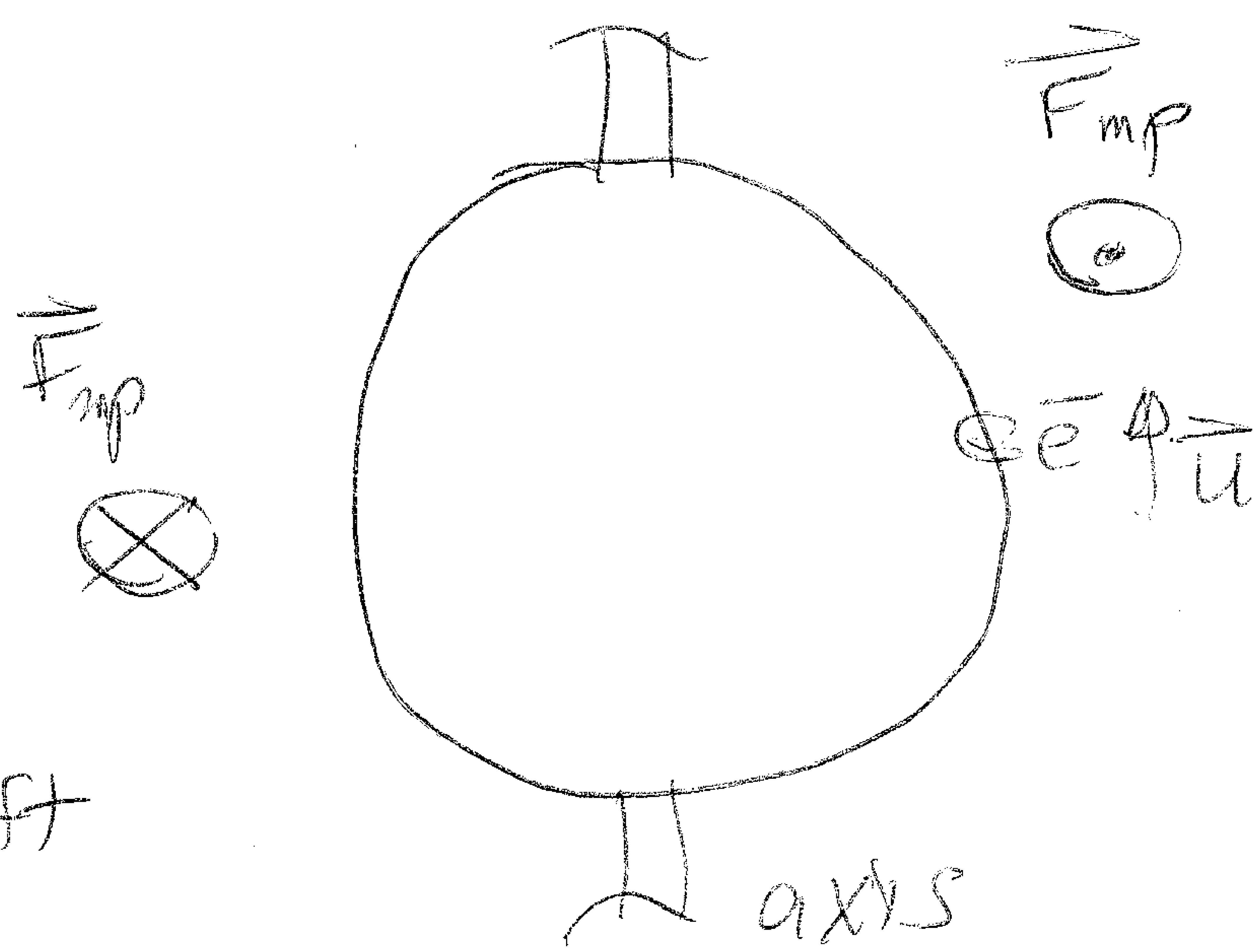
The Lorentz magnetic force has a normal component $\vec{F}_{mn}$ which does <u>no</u> work, <u>no</u> torque, & cannot spin the loop because it points radially. When the stator & rotor poles align, the parallel component is 0, $\vec{F}_{mp} = 0$, & $\vec{F} = \vec{F}_{mn}$, so that no torque/work exists.

The parallel Lorentz magnetic force component, $\vec{F}_{mp}$ acts along the direction where torque is produced & spins the loop.

The right hand side of the loop is heading upward towards the reader, left hand side downward.



Summary: The Lorentz force component due to $\vec{B}$, parallel sub-component, is what spins the loop.

Now let us examine $\vec{E}$:

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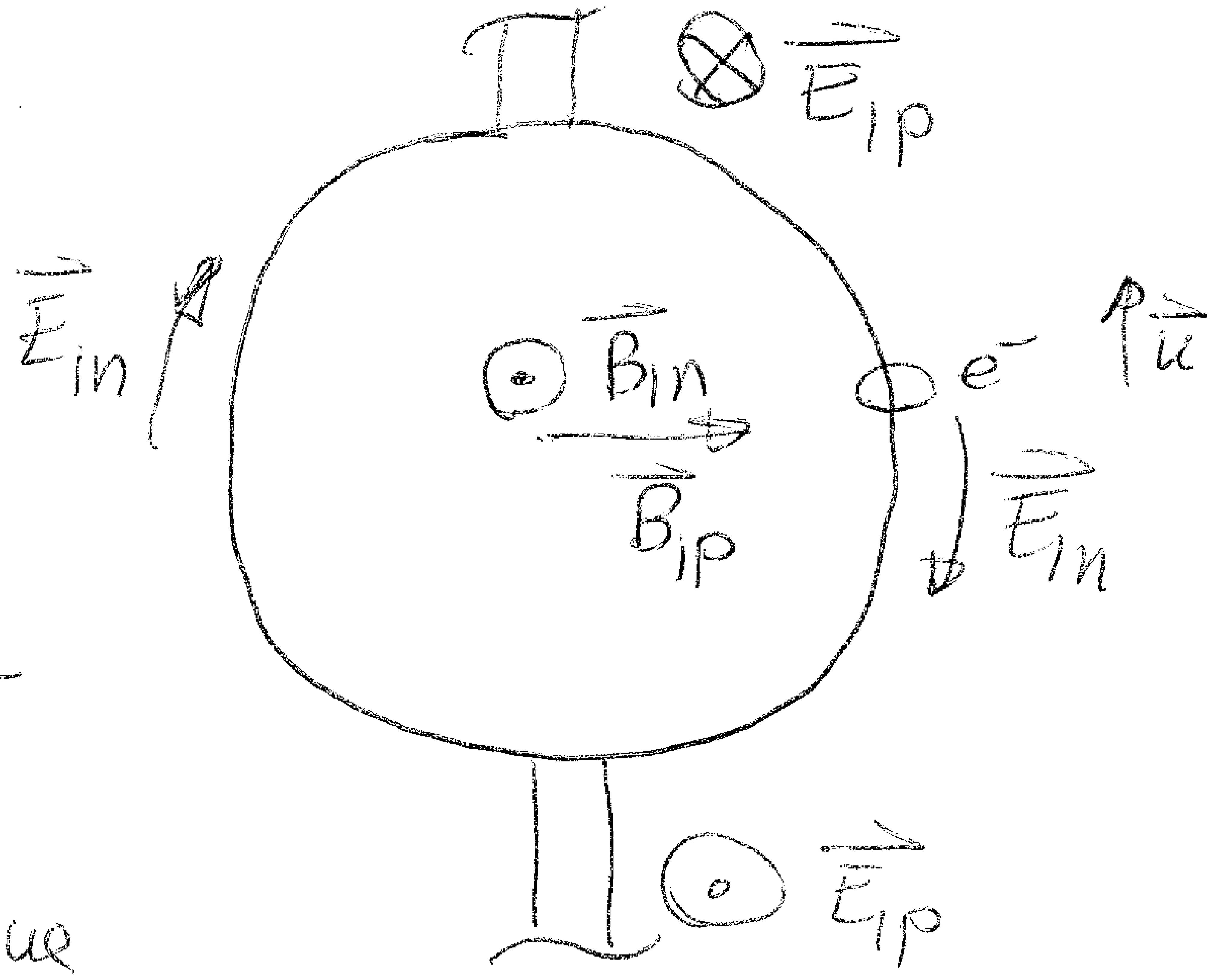

$\vec{E}_{1n}$ is the induced $\vec{E}$ field due to the *normal* component of $\vec{B}_1$, or $\vec{B}_{1n}$.

$\vec{E}_{1p}$ is induced $\vec{E}$ field due to *parallel* component of $\vec{B}_1$, or $\vec{B}_{1p}$.

The $\vec{E}_{1p}$ vectors due not produce torque, they act in wrong direction. But the $\vec{E}_{1n}$ vectors produce e^- drift in wire per $\vec{F} = q\vec{E}$ & $\vec{J} = \sigma\vec{E}$.

Thus the induced $\vec{E}$ field from the *normal* component of $\vec{B}_1$ results in loop 2 induced current, which *makes* torque possible since dipole is needed, & e^- motion needed for $\vec{F}_M$ to occur.

But it is the *parallel* component of $\vec{B}_1$ that spins the loop with torque. Interesting!

Happy studying

Claude Abraham