

Magnetic force between two moving charged particles

a. According to the Biot-Savart law, the magnetic field at particle 2 due to particle 1 is

$$\vec{B} = \frac{\mu_0}{4\pi} \frac{q_1}{r_{12}^2} \vec{v}_1 \times \hat{r}_{12}.$$

But according to the Lorentz force law, the force on particle 2 from this field is

$$\vec{F}_{\text{on 2 by 1}} = q_2 \vec{v}_2 \times \vec{B}.$$

Putting these two together blindly says that

$$\vec{F}_{\text{on 2 by 1}} = \frac{\mu_0}{4\pi} \frac{q_1 q_2}{r_{12}^2} \vec{v}_2 \times (\vec{v}_1 \times \hat{r}_{12}).$$

b.

