Beam Size Measurements Using Sextupole Magnets in the Cornell Electron/Positron Storage Ring*

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Lorentz force equation

$$\vec{F} = q\,\vec{v} \times \vec{B}$$

Sextupole magnetic field

$$B_y(x) = B_y'' \, x^2$$

Beam bunch Gaussian charge distribution

$$q = q_0 \int_{-\infty}^{+\infty} \exp\left(\frac{-(x-x_0)^2}{\sigma^2}\right) dx$$

Average force on the charge distribution

$$\langle F_x \rangle_{x_0,\sigma} = q_0\, B_y'' \int_{-\infty}^{+\infty} x^2 \exp\left(\frac{-(x-x_0)^2}{\sigma^2}\right) dx$$

$$= q_0\, B_y'' \,(x_0^2 + \sigma^2)$$

1) Original idea, potentially seminal work

2) Basic accelerator physics formalism

3) Measurements February-May now available for all 76 CESR sextupole magnets

4) Data analysis software infrastructure exists

This REU Project
* Perform data analysis
* Evaluate/quantify measurement accuracy
* Prepare for publication

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