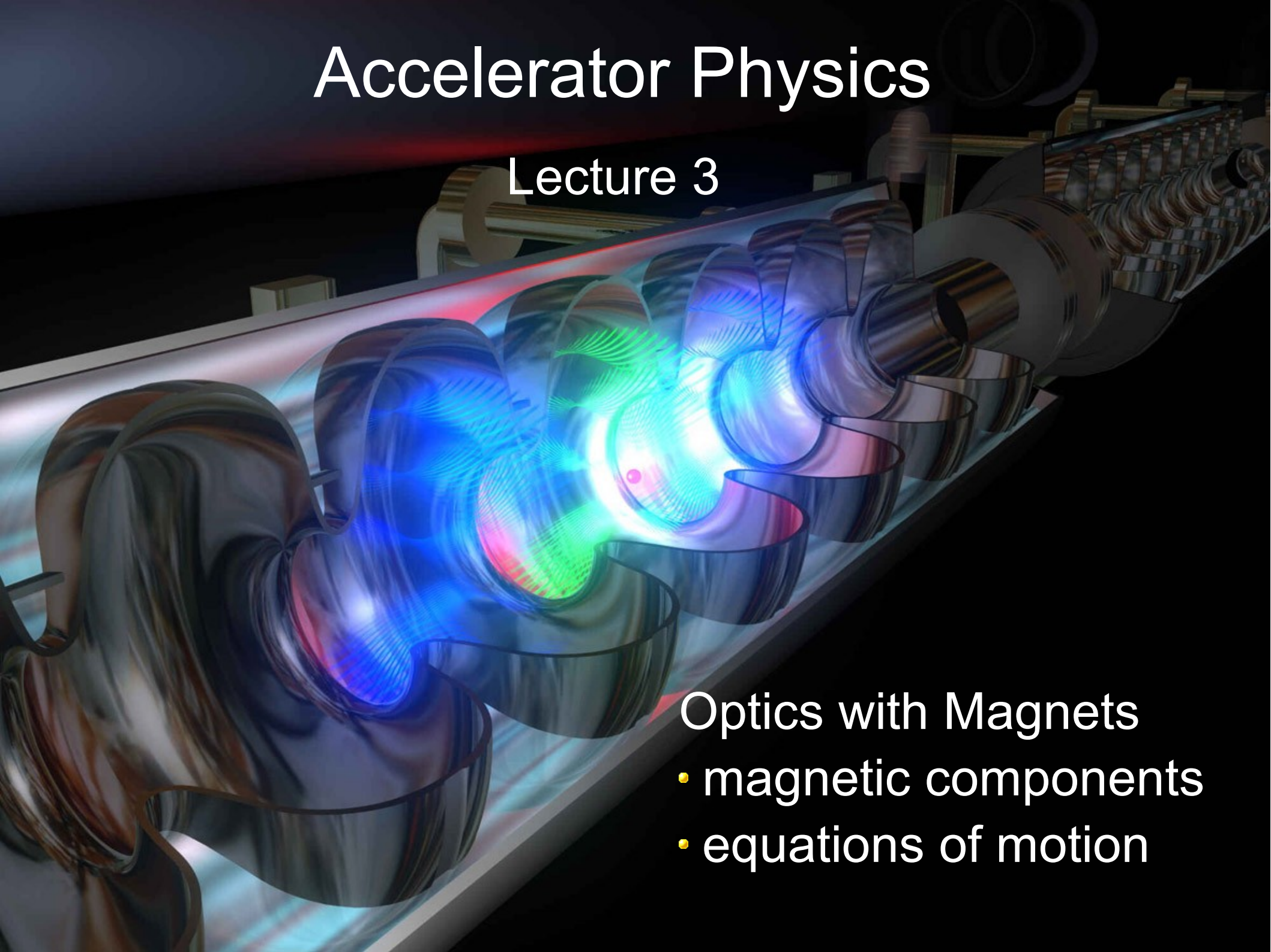


# Accelerator Physics

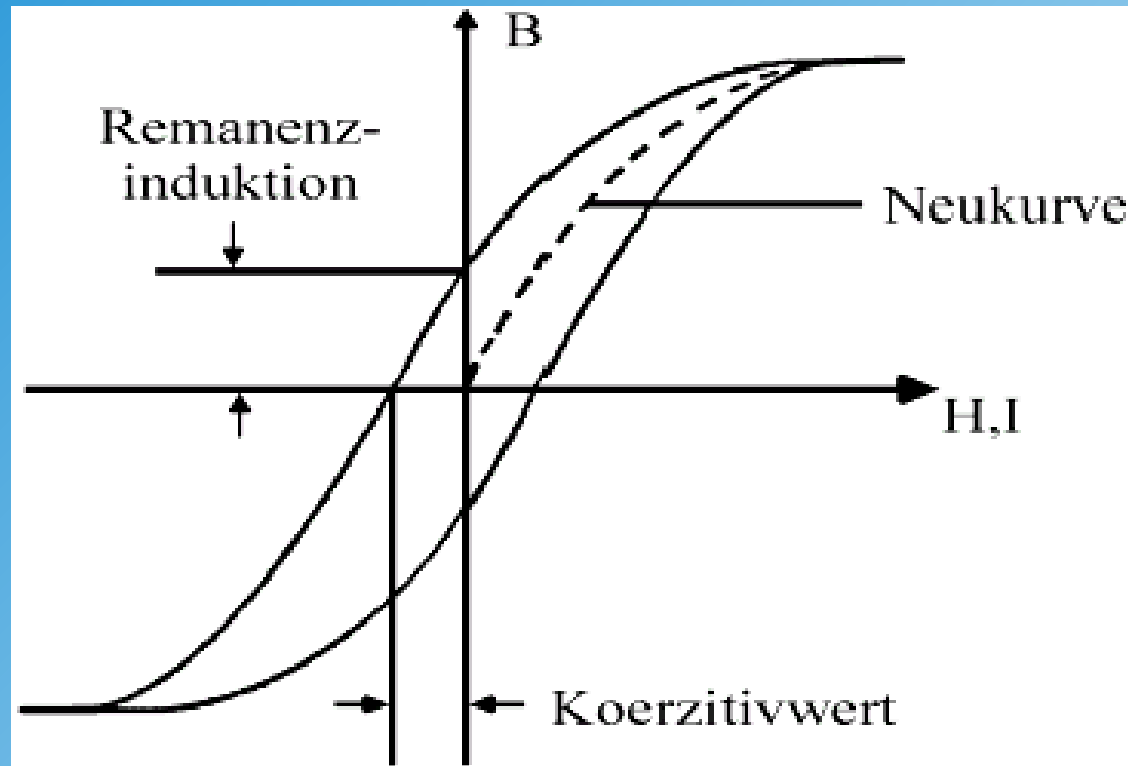
## Lecture 3



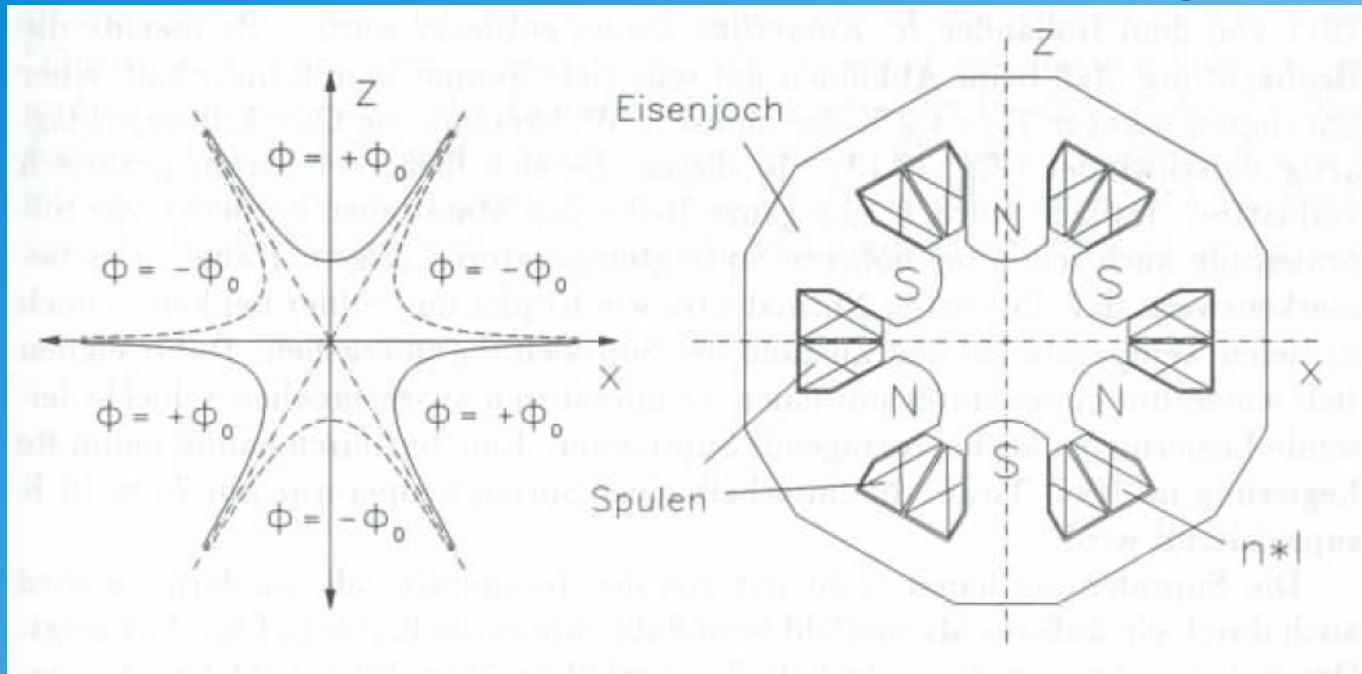
### Optics with Magnets

- magnetic components
- equations of motion

# Magnetic Hysteresis



# Sextupole Magnet

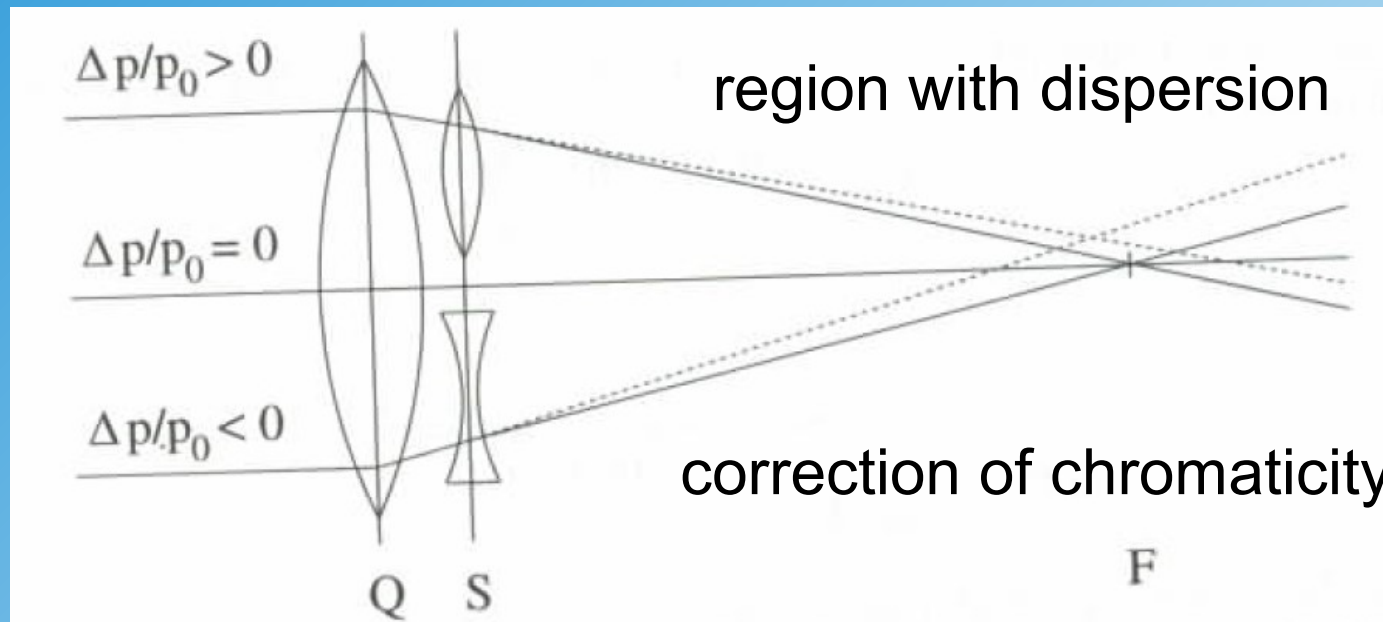


$$\Phi = -\frac{g_s}{2} \left( x^2 y - \frac{y^3}{3} \right)$$

$$B_x = g_s xy$$

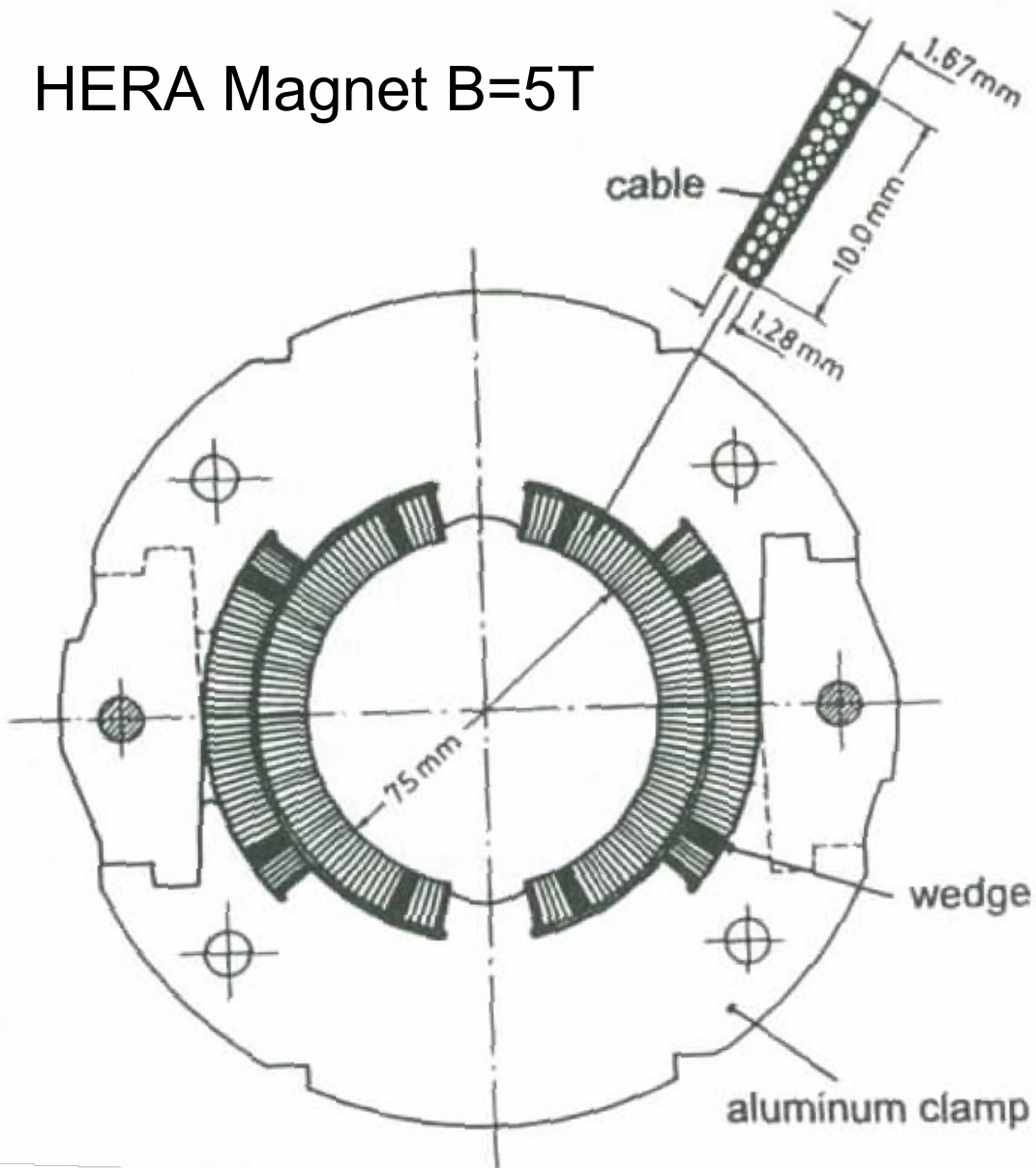
$$B_y = \frac{1}{2} g_s (x^2 - y^2)$$

$$g_s = 6\mu_0 \frac{nI}{a^3}$$



# Superconducting Magnet

HERA Magnet  $B=5T$



14  $\mu\text{m}$  Niob titanium wires ( $<4K$ ) embedded in copper matrix

$\sim$  factor 5 stronger fields with SC

# Standard Coordinate System

