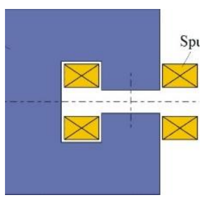
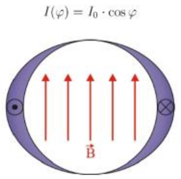
Recap 1st Lecture

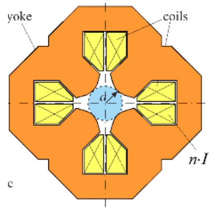
Magnetic Rigidity $B\rho$: corresponding beam momentum $p = qB\rho$ defined by the bending magnets

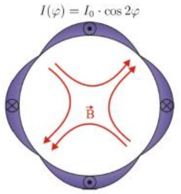
Beam Guidance: dipole strength $\kappa = \frac{1}{\rho} = \frac{q}{p}B_0$, $[\kappa] = \text{m}^{-1}$ (curvature)





Beam Focusing: quadrupole strength $k = -\frac{q}{p}\frac{\partial B_y}{\partial x}$, $[k] = \text{m}^{-2}$ $\left(\frac{1}{f} = kL\right)$





Magnetic Multipoles: $2n$ poles, “normal” and “skew”, rotational symmetry $\frac{2\pi}{n}$ $s_n = \frac{q}{p}\frac{\partial^{n-1}B_y}{\partial x^{n-1}}$, $[s_n] = \text{m}^{-n}$

Paraxial Optics: trajectory described by offsets (x, x', y, y') from design orbit, displacements $x, y \ll \rho$

Geometric Optics: Each element i is represented by transfer matrix $\mathbf{M}_i$, trajectory from $\vec{x} = \prod_{i=1}^{n}\mathbf{M}_i \cdot \vec{x}_0$

Matrices (simple approx.): dipole and drift $\mathbf{M}_D = \begin{pmatrix} 1 & L \\ 0 & 1 \end{pmatrix}$ quadrupole $\mathbf{M}_Q = \begin{pmatrix} 1 & 0 \\ \pm 1/f & 1 \end{pmatrix}$