# In summary

## Normal Magnetoresistance

$$\frac{R(B)-R(0)}{R(0)} = \frac{\Delta R}{R} = f\left(B/R(0)\right)$$

## Anisotropic Magnetoresistance

$$\frac{R_{\parallel}-R_{\perp}}{R_{\perp}} = \frac{\Delta R}{R} \approx \gamma(\alpha-1)$$

$\gamma \approx 0.01$; $\alpha = \frac{\rho_{\downarrow}}{\rho_{\uparrow}}$

$\alpha > 1$ for Fe, Co, Ni

$\alpha = 3$ for Fe, $\alpha = 7$ for Co.

## Giant Magnetoresistance

$$\frac{\Delta R}{R} = \frac{R_{AP}-R_P}{R_P} = \frac{(\alpha-1)^2}{4\alpha}$$

$R_{AP} > R_P$ typically.

## Tunnel Magnetoresistance

$$\frac{\Delta R}{R} = \frac{R_{AP}-R_P}{R_P} = \frac{2P_1P_2}{1-P_1P_2}$$

$P \rightarrow$ spin-polarization

$$P_{1(2)} = \frac{D^{\uparrow}_{1(2)} - D^{\downarrow}_{1(2)}}{D_{1(2)} + D_{1(2)}}$$

$D \rightarrow$ Density of states