

Condensed Matter Physics I

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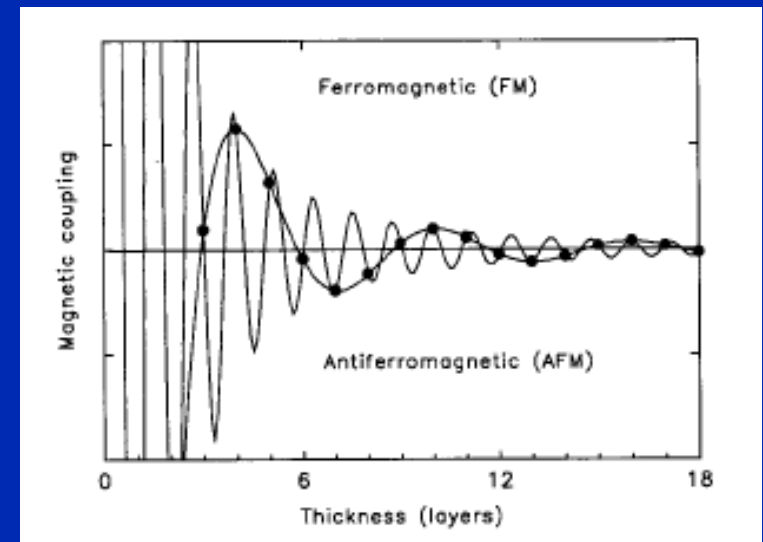
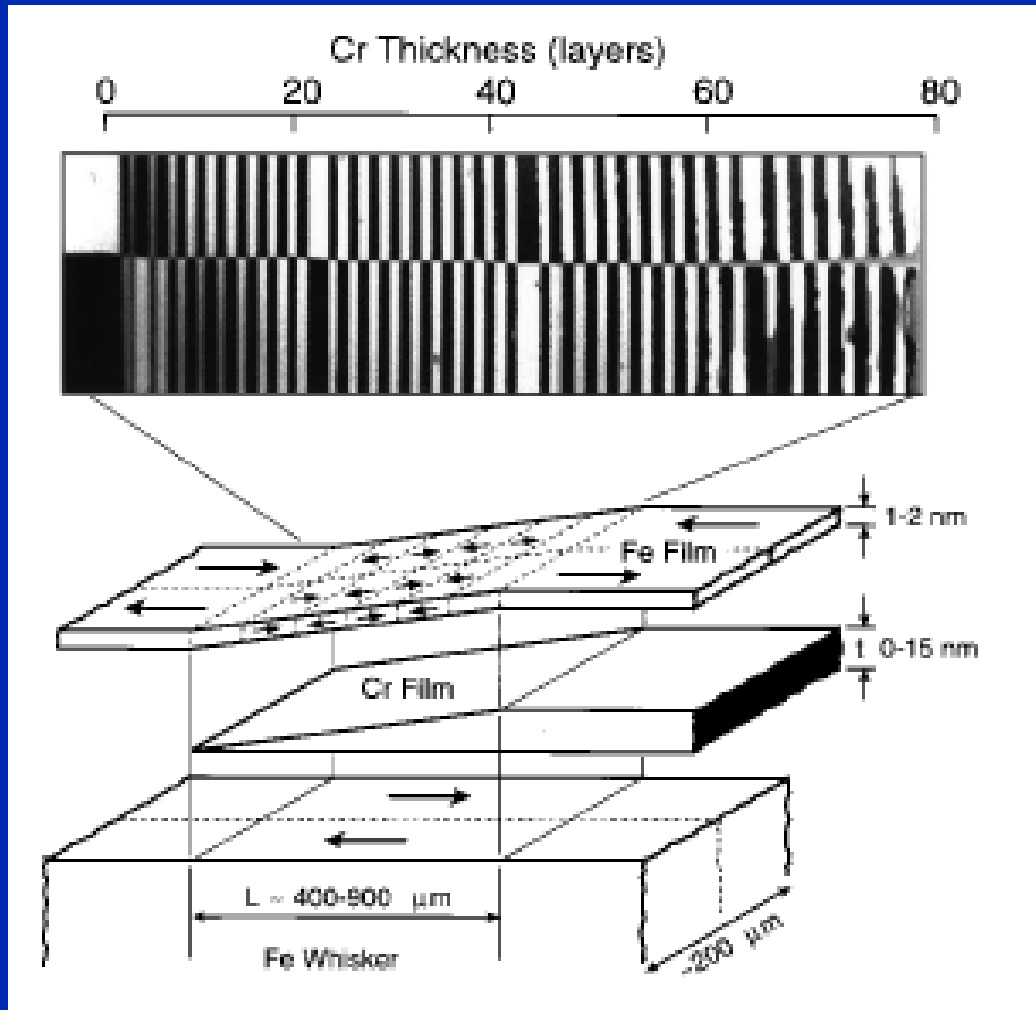
Website: <http://www.loosdrecht.net/>

Last time

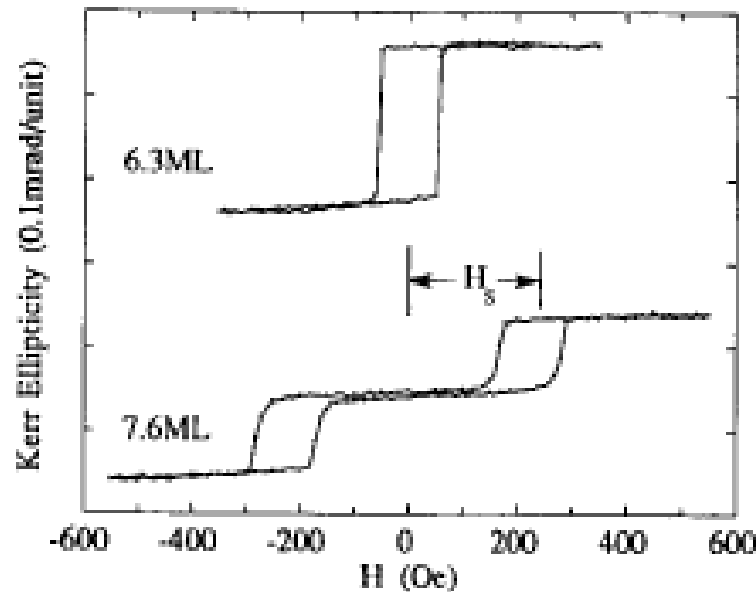
Last time: Interactions
Stoner magnetism

Today: RKKY interaction
Spin waves

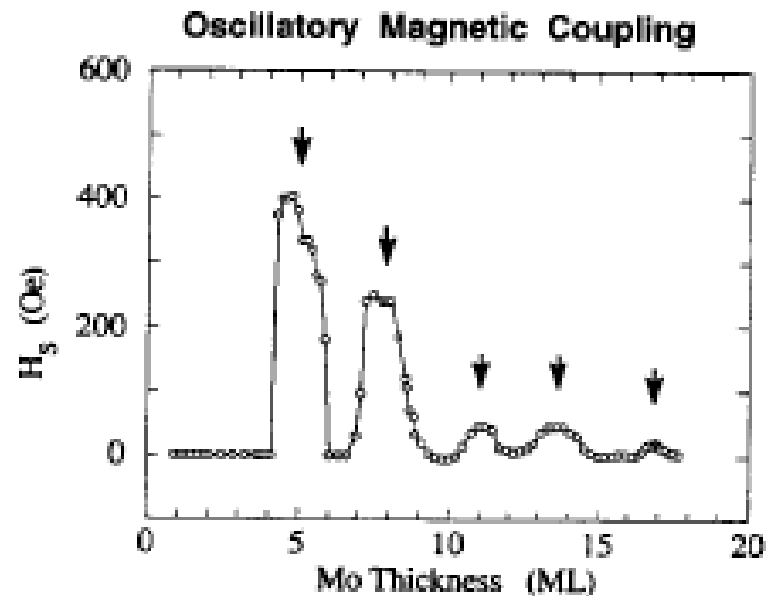
RKKY interaction



RKKY interaction



(a)

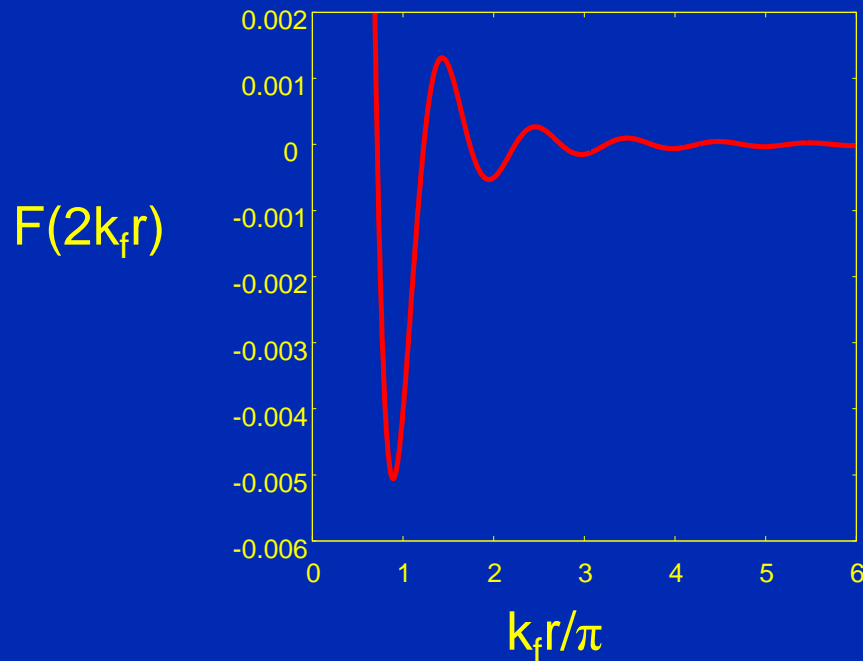


(b)

Figure 38. Magnetic oscillations at Fe/Mo/Fe(100) trilayers determined by the SMOKE (Qiu *et al.* 1992b). (a) Hysteresis loops characteristic of parallel and antiparallel coupling (top and bottom). H_s is the magnetic field required to force antiparallel layers parallel. Adding just slightly more than a monolayer to the Mo spacer reverses the magnetic orientation. (b) Alternating antiparallel and parallel coupling (arrows and baseline respectively).

Spatially varying fields

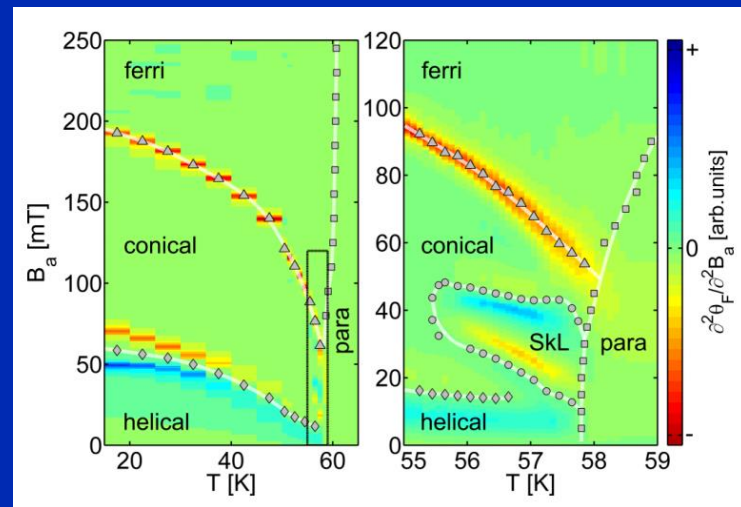
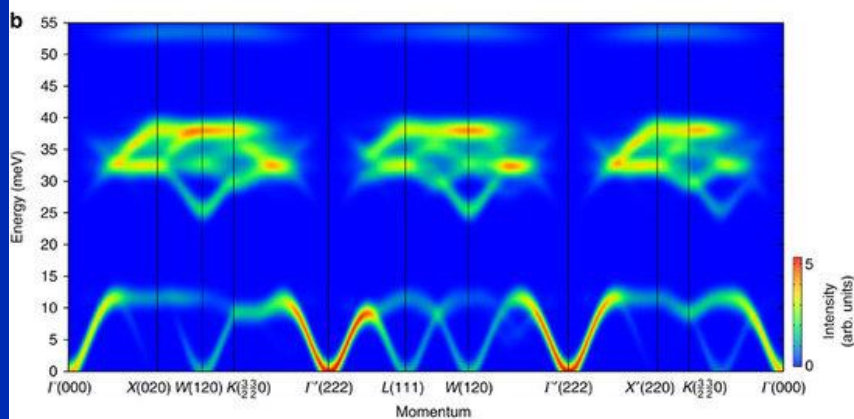
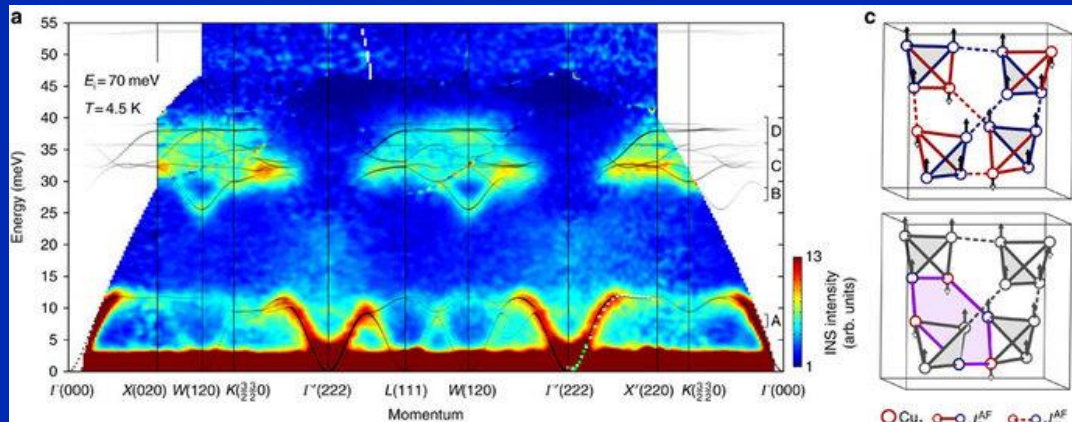
- RKKY interaction (*Ruderman-Kittel-Kasuya-Yosida*)



$$H(r) = H \delta(r)$$

$$\chi(r) = \frac{2}{\pi} k_f^3 \chi_{\text{pauli}} F(2k_f r) \stackrel{x \gg 1}{=} -\frac{2}{\pi} k_f^3 \chi_{\text{pauli}} \frac{\cos(2k_f r)}{(2k_f r)^3}$$

Spin wave excitations in Cu_2OSeO_3



R. Versteeg et al., PRB 2016

P. Y. Portnichenko et al., Nat. Comm. 2016

