

NS003: Magnetism

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Optical Condensed Matter Physics

Magnetism in Condensed Matter

Stephen Blundell

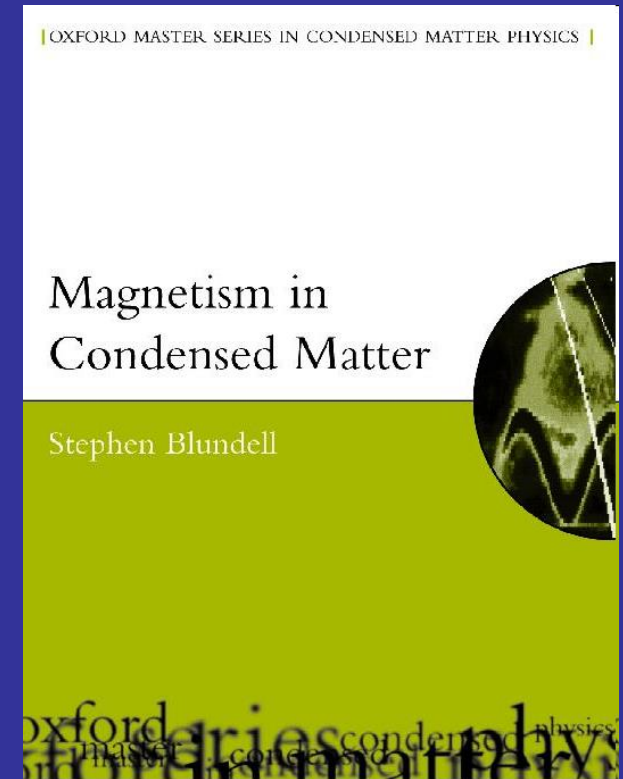
Oxford Master Series in Condensed matter

Oxford University press 2003

ISBN 0 19 850591 4

Powerpoint slides

Notes made during lectures



Additional literature: Kittel; Ashcroft&Mermin; your favorite solid state book

Parts of the book TBS

Ch. 1	Introduction	Complete
Ch. 2	Isolated moments	2.1-2.5
Ch. 3	Environments	3.1
Ch. 4	Interactions	Complete
Ch. 5	Order & magnetic structure	5.1-5.3
Ch. 6	Order & broken symmetry	6.1-6.7
Ch. 7	Magnetism in metals	7.1-7.7
Ch. 8	Competing interactions	8.1-8.9

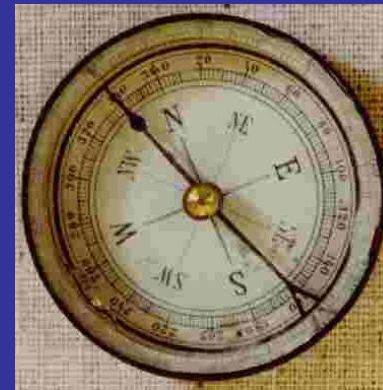
Lectures

Lect. 1	Introduction	Ch.1; 2.1-2.5; 8.9
Lect. 2	Interactions, environment	3.1, Ch.4; 7.1-7.7
Lect. 3	Ordering, Domains	5.1-5.3; 6.7; 8.3, 8.7, 8.8
Lect. 4	Symmetry breaking	6.1-6.6
Lect. 5	Quantum magnetism	8.1-8.6

Introduction

Today: Introduction (Ch.1; 2.1-2.5; 8.9)

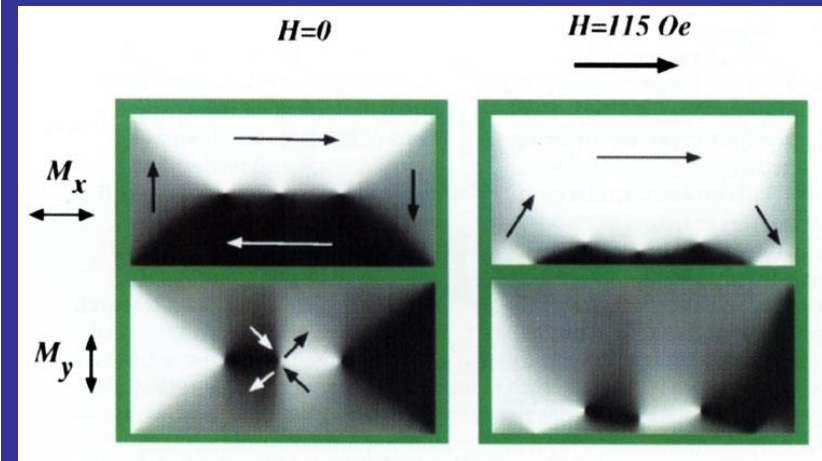
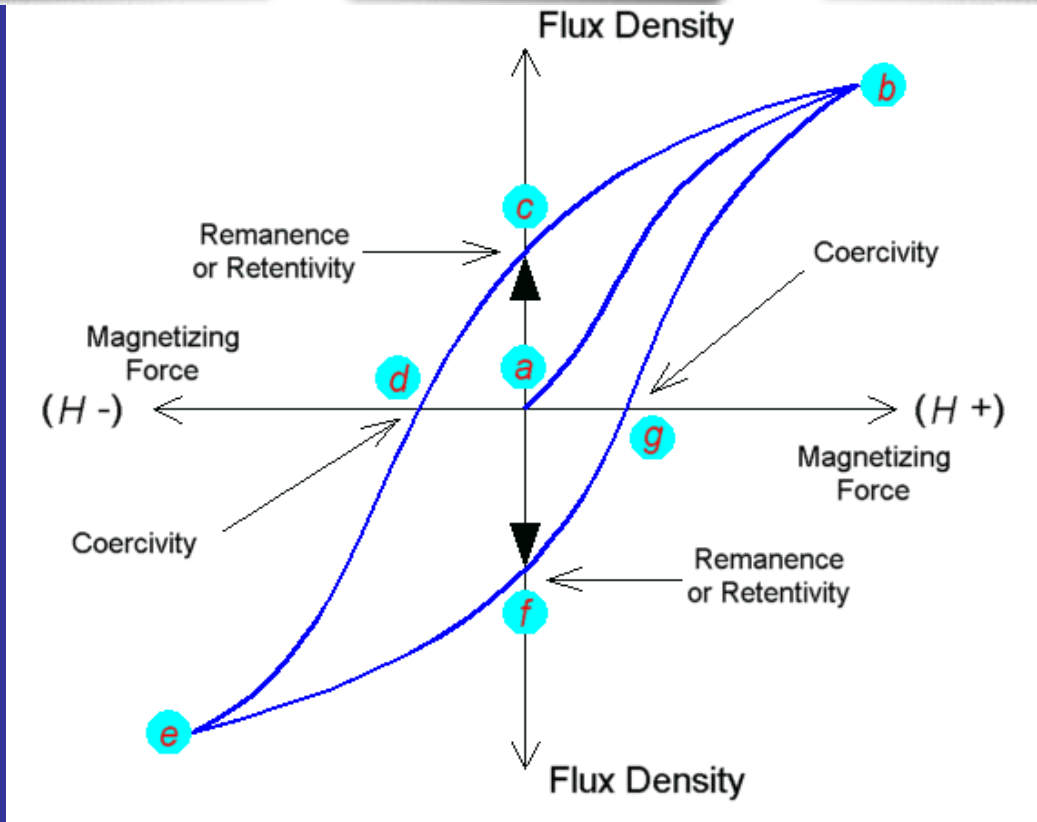
Next time: Interactions, environment (3.1, Ch.4; 7.1-7.7)



6c BC Thales, loadstone

1c AD chinese compass

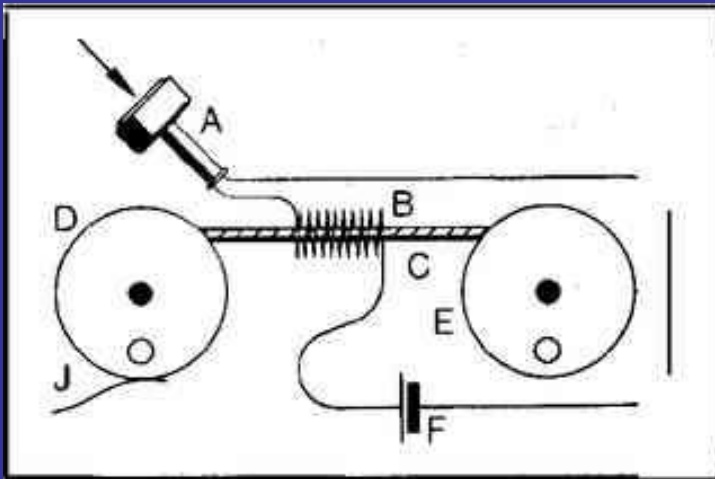
Ferromagnetic hysteresis



Domains
Anisotropy



Data storage

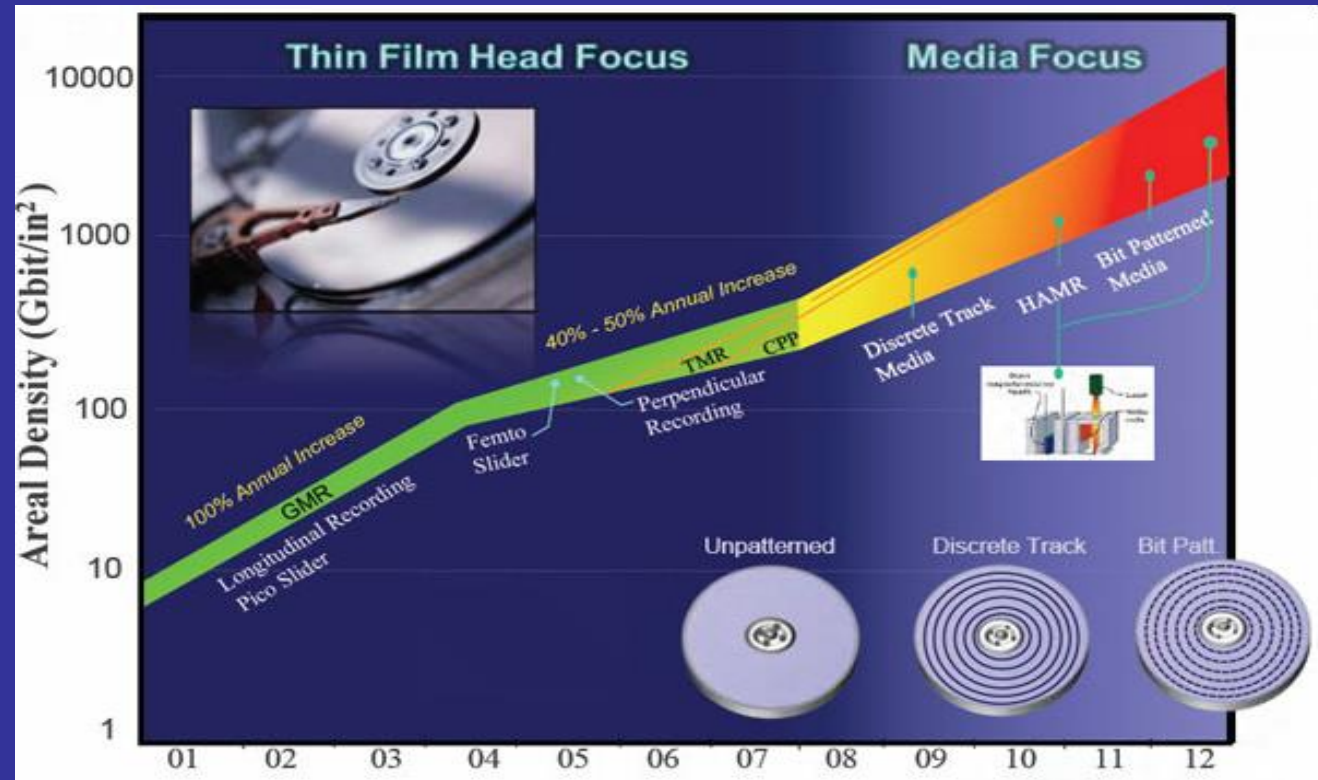


1898 Valdemar Poulsen
Telegraphone answering machine
Wire @ 250 cm/s (1 hr = 10 km)

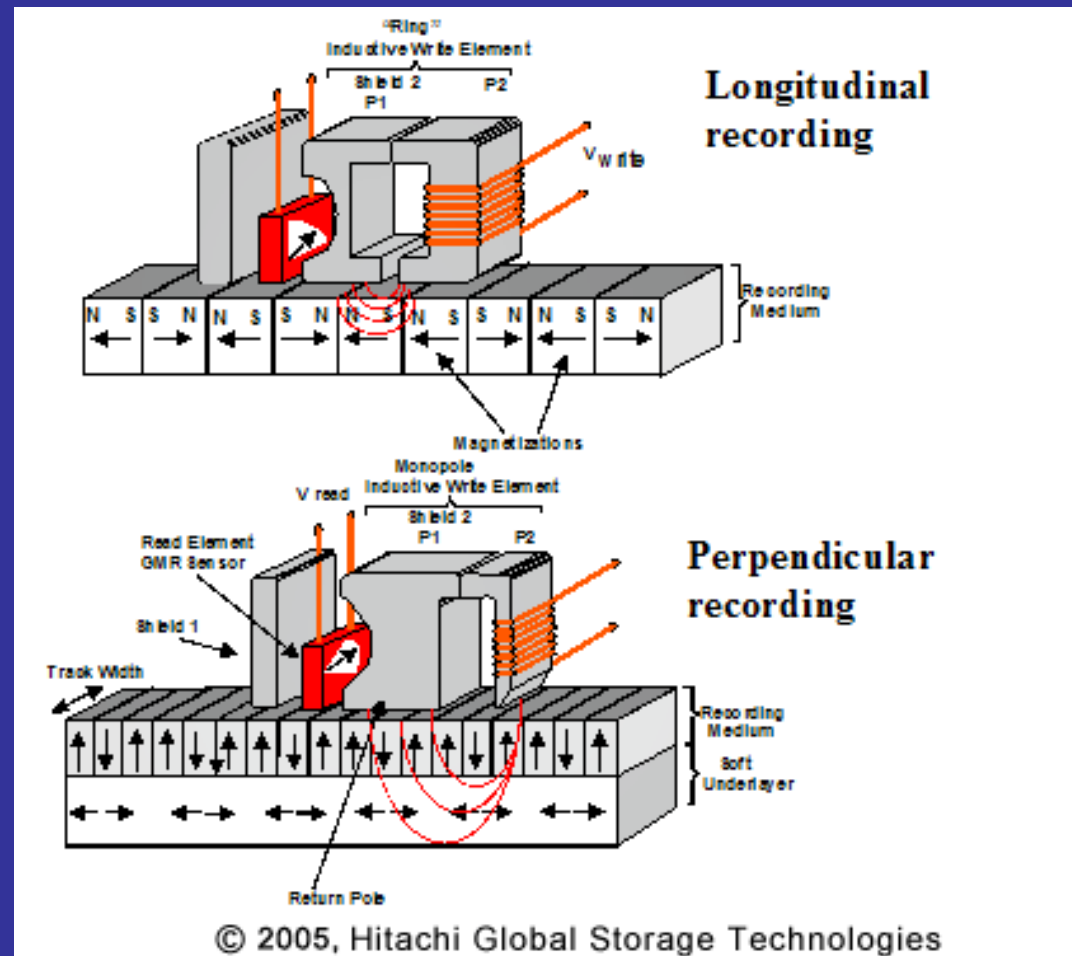
Oberlin smith 1888



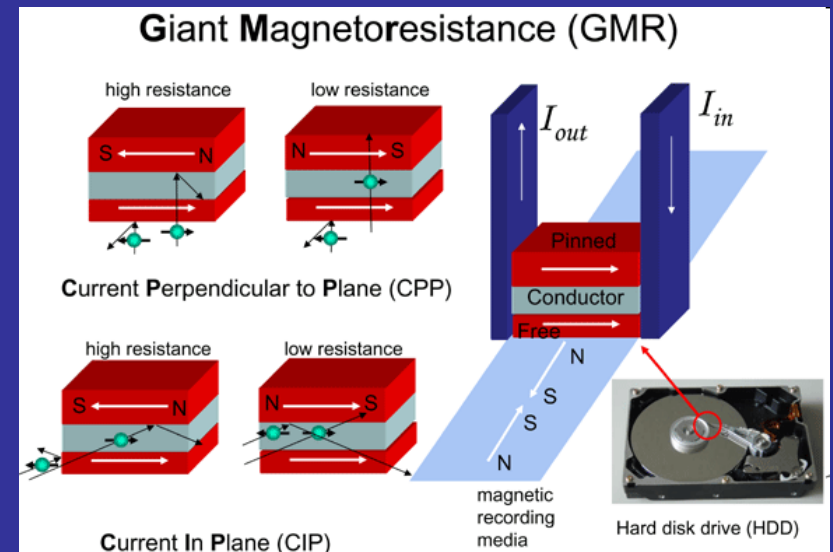
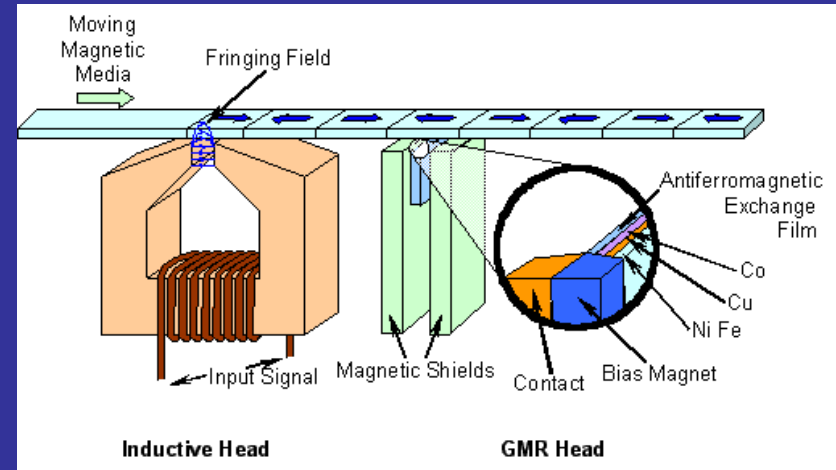
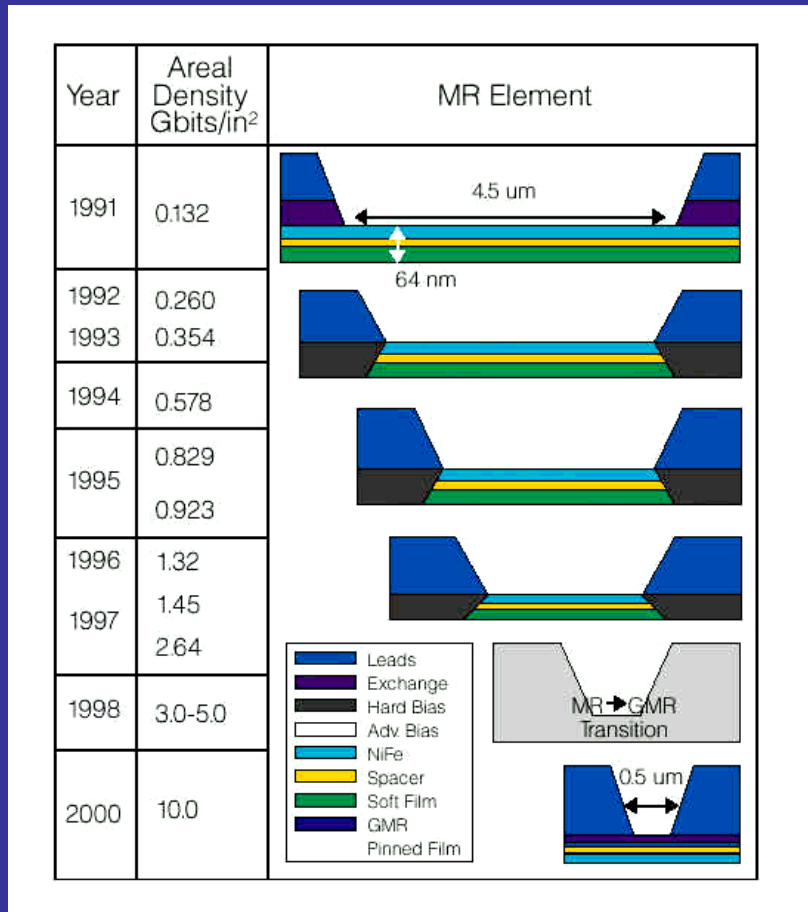
Today:
329 Gb/inch² (seagate, jan 2008)



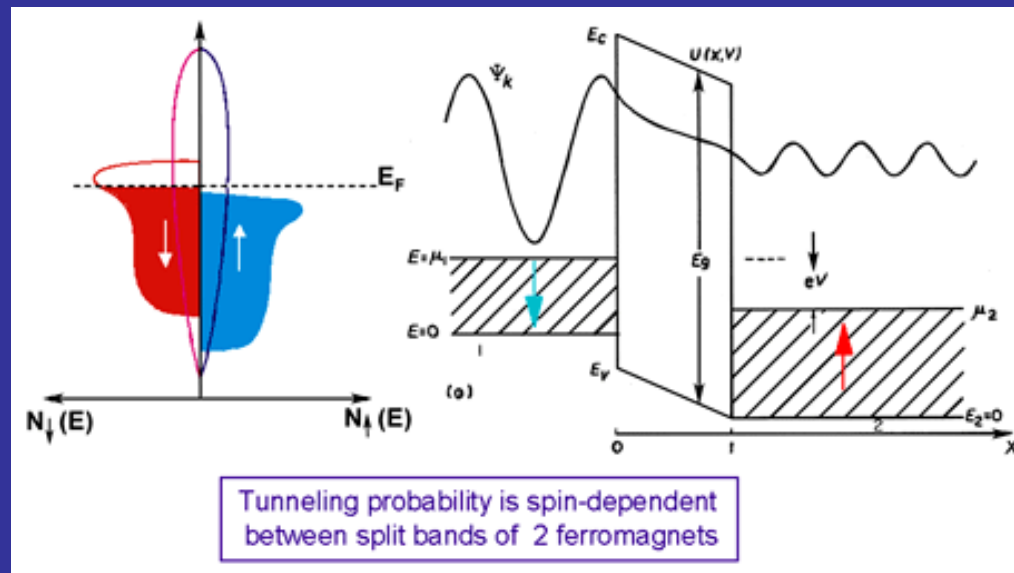
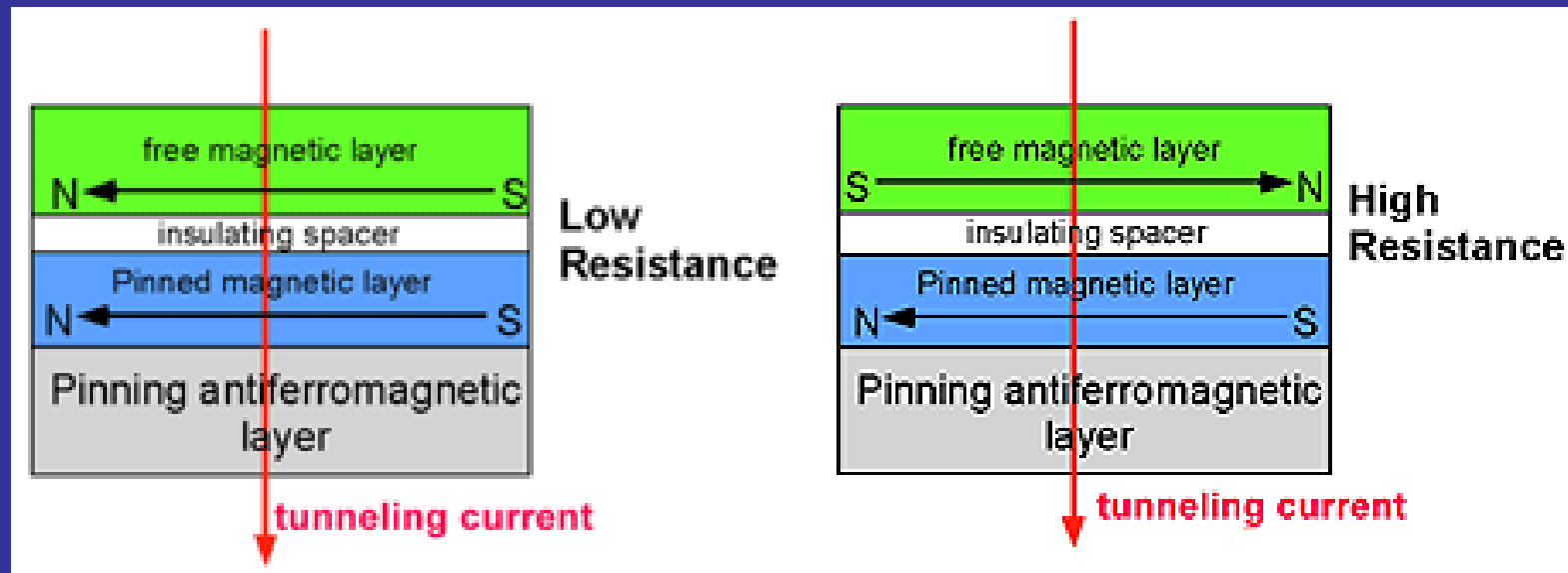
Perpendicular recording



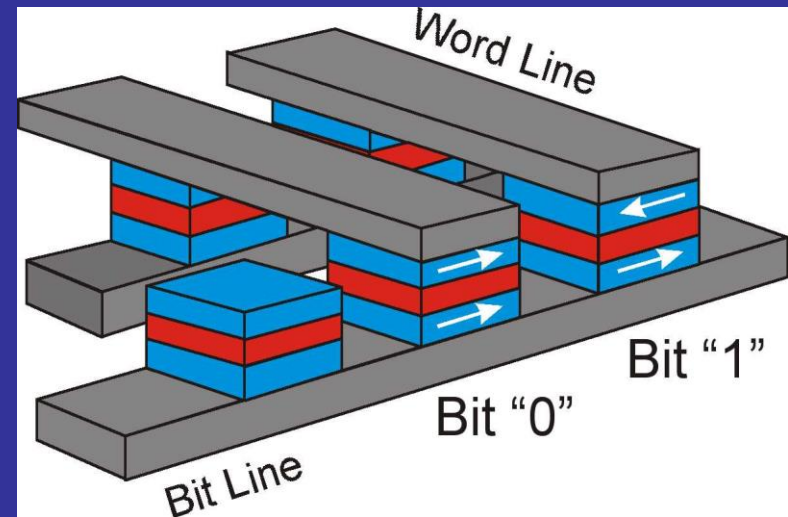
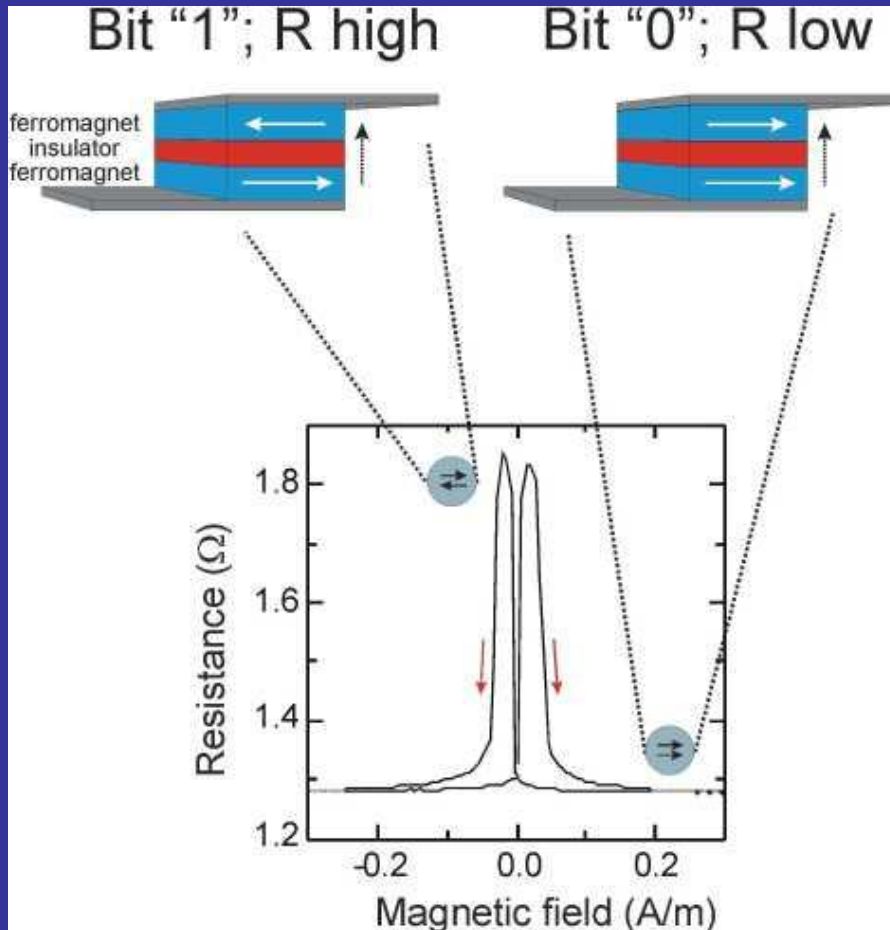
MR and GMR heads



Tunneling magnetoresistance

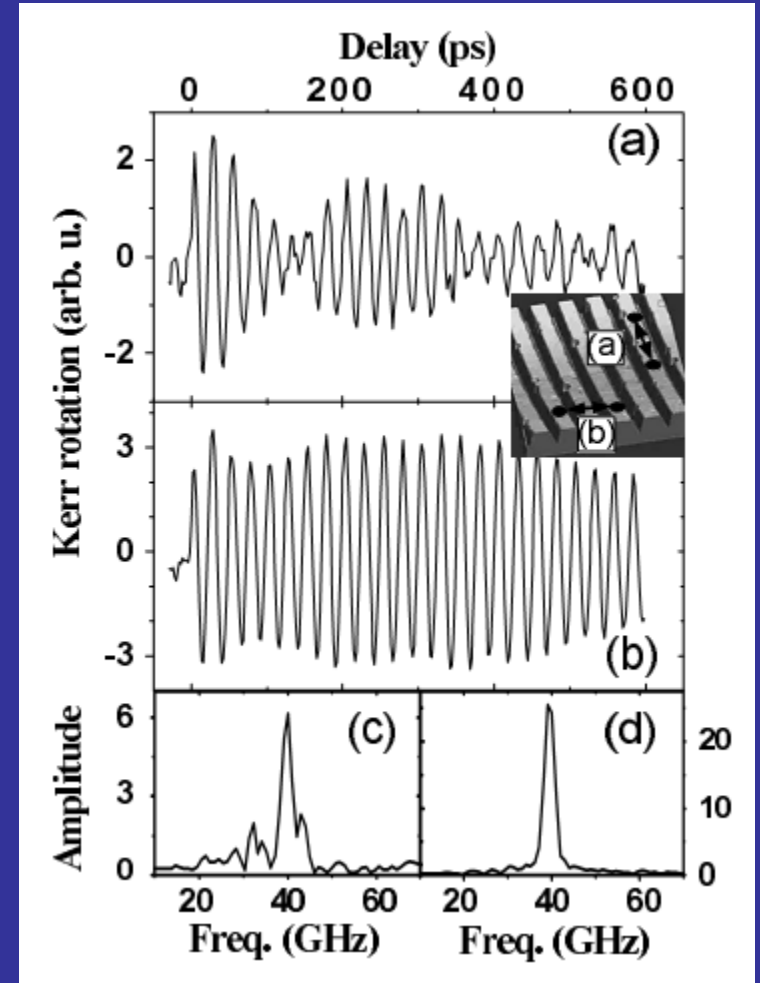
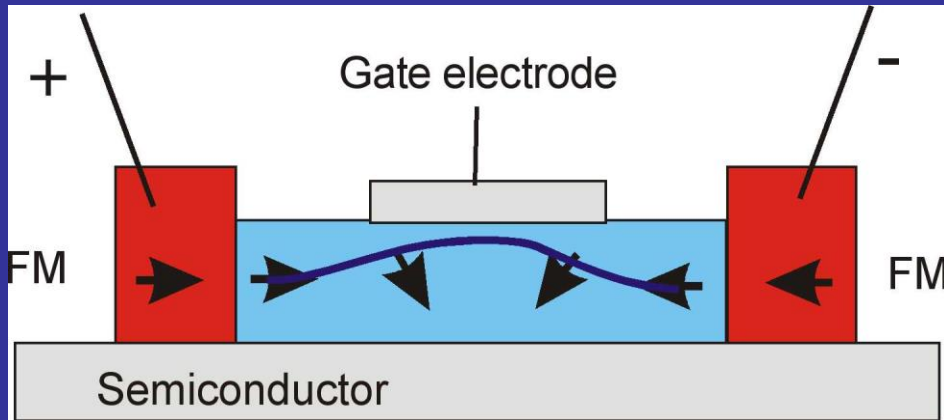


MRAM

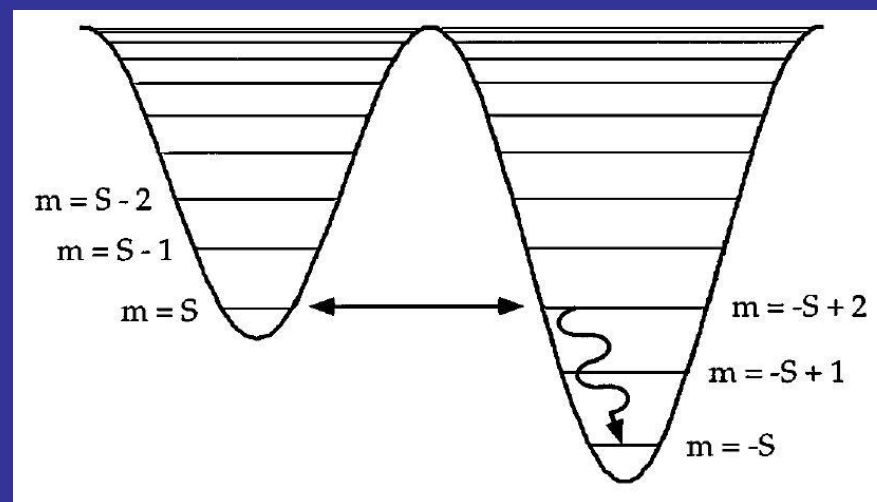
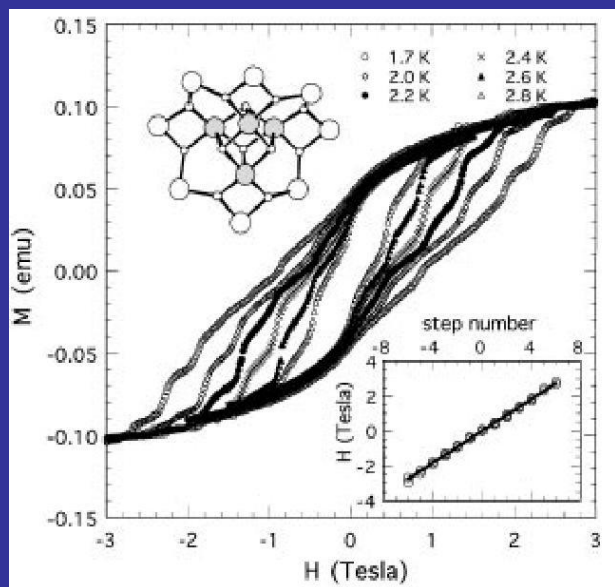
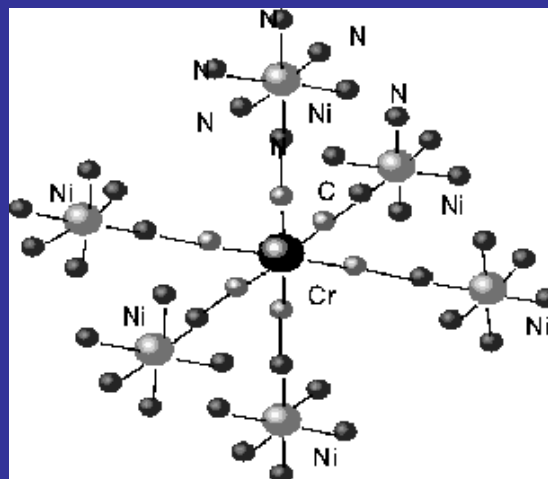
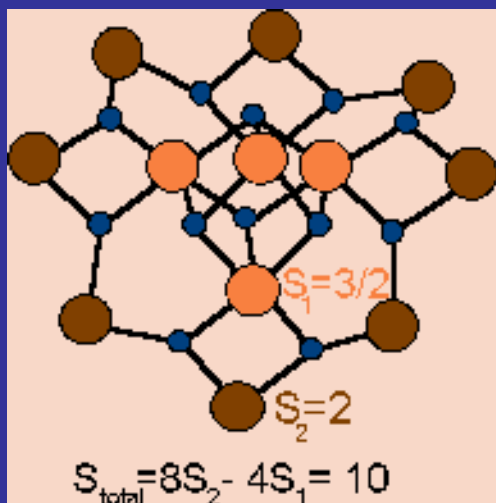


Spintronics

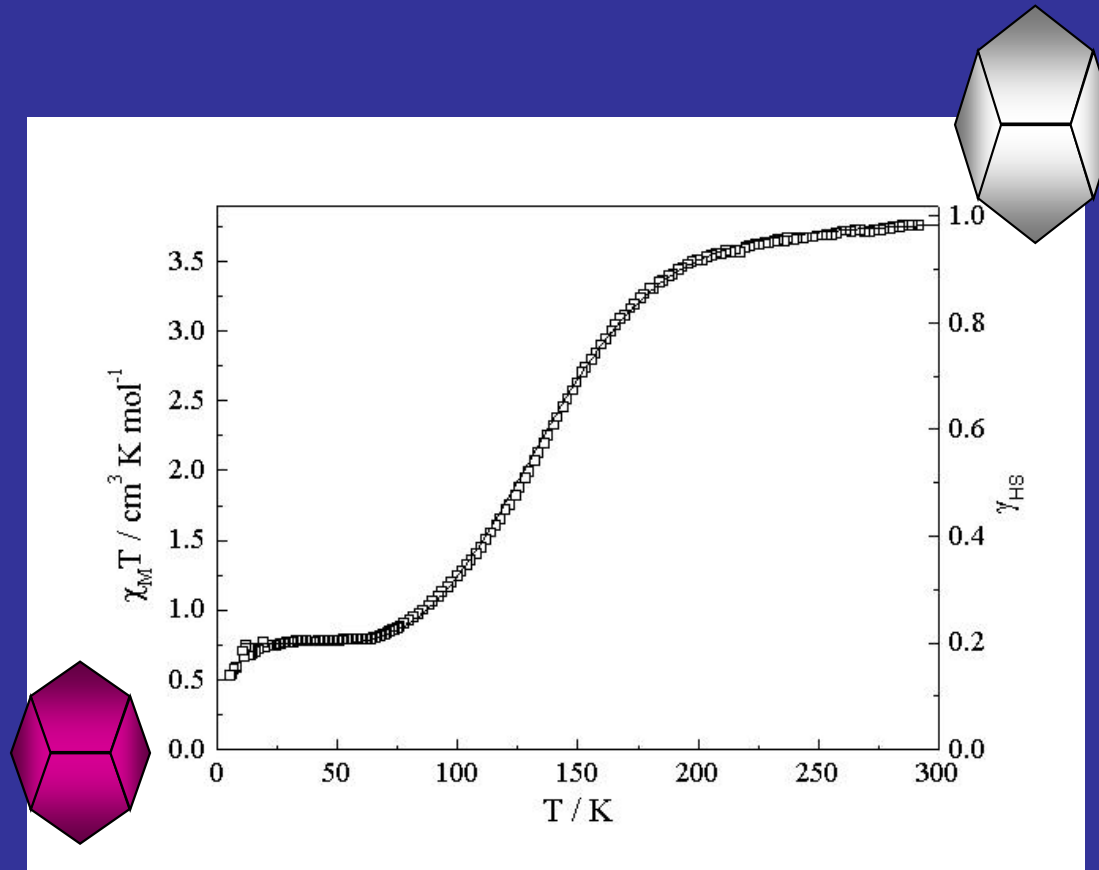
Spin dependent transport



Molecular nanomagnets



Molecular magnets: spin state switching

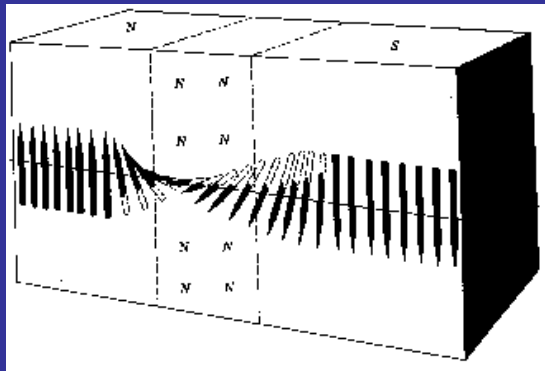
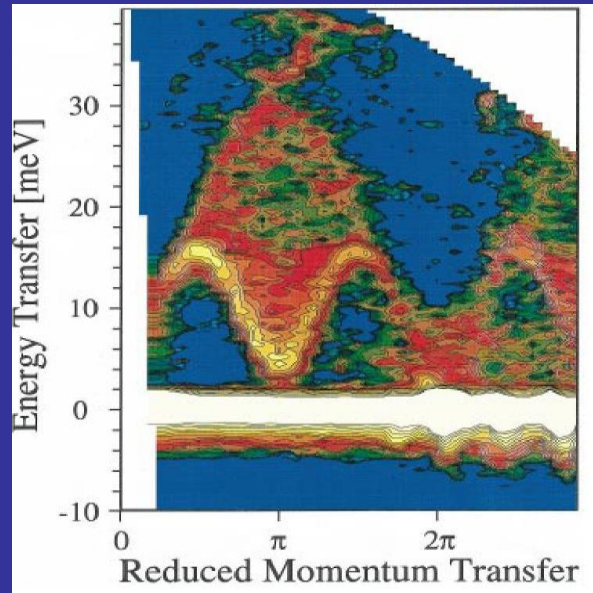


100 K, Fe(II) LS: Fe–N = 2.038(4) Å Fe–Fe = 7.273(2) Å

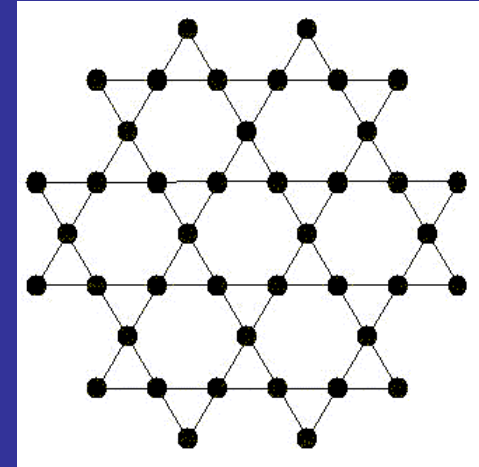
200 K, Fe(II) HS: Fe–N = 2.164(4) Å Fe–Fe = 7.422(2) Å

Frustration and quantum magnetism

Spin liquids and Spin ice



Geometric frustration



Kagome lattice

