Magnetic Recording

Prospects and Retrospect

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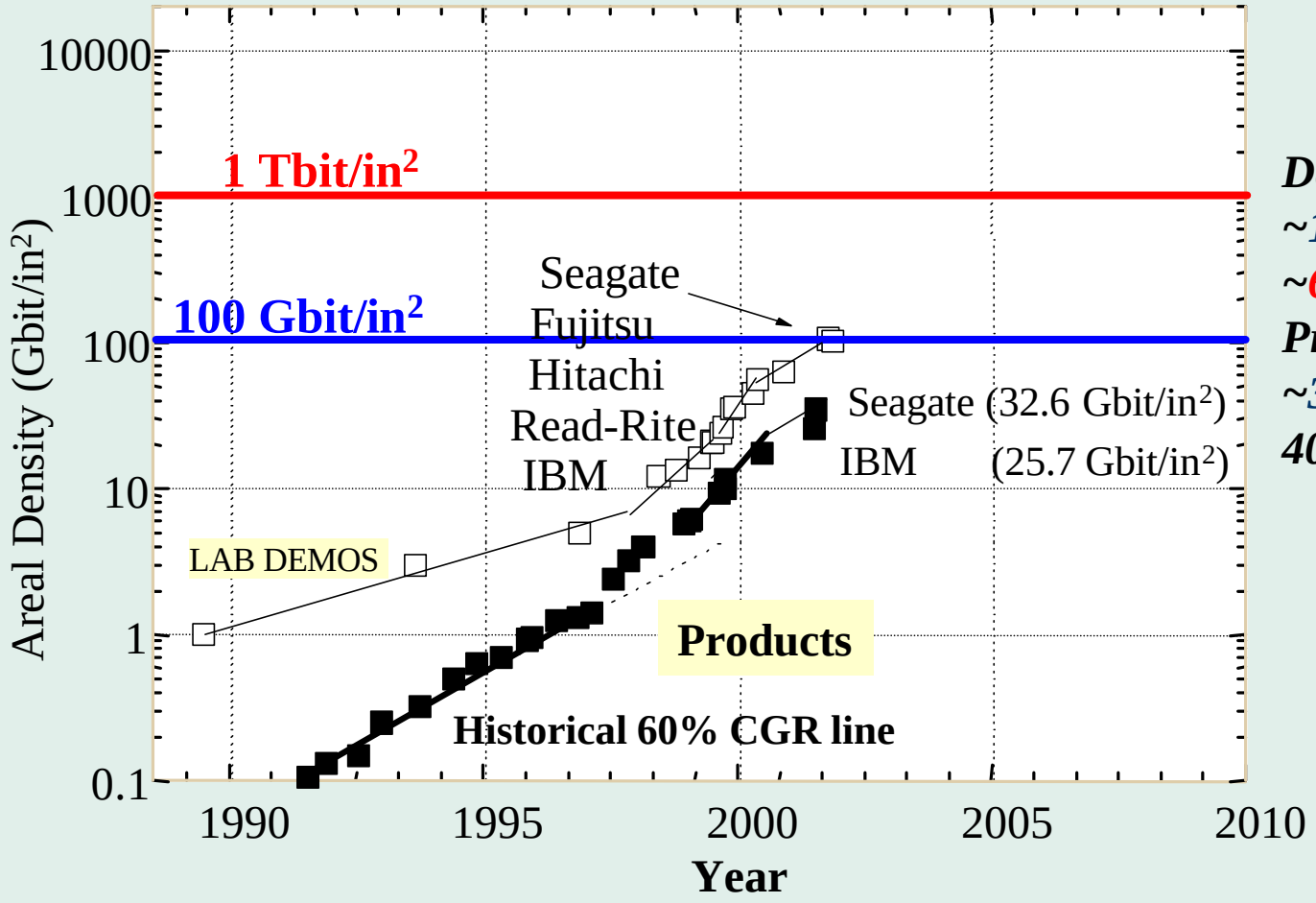
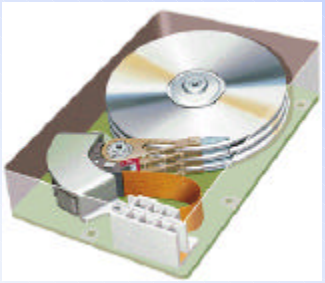
Progress in Magnetic Data Storage



Demos:
~100 Gbpsi long
~63 Gbpsi perp
Products:
~33 Gbpsi long
40 GB per disk

Scaling: From RAMAC to Microdrive

4.4 MB



1 GB

70 kbit/s
IBM RAMAC 1955
2 kbits/in^2
50x24” dia disks

32 Mbit/s
IBM Microdrive 2001
15.2 Gbits/in^2
1 x 1” dia disk

Technology Options

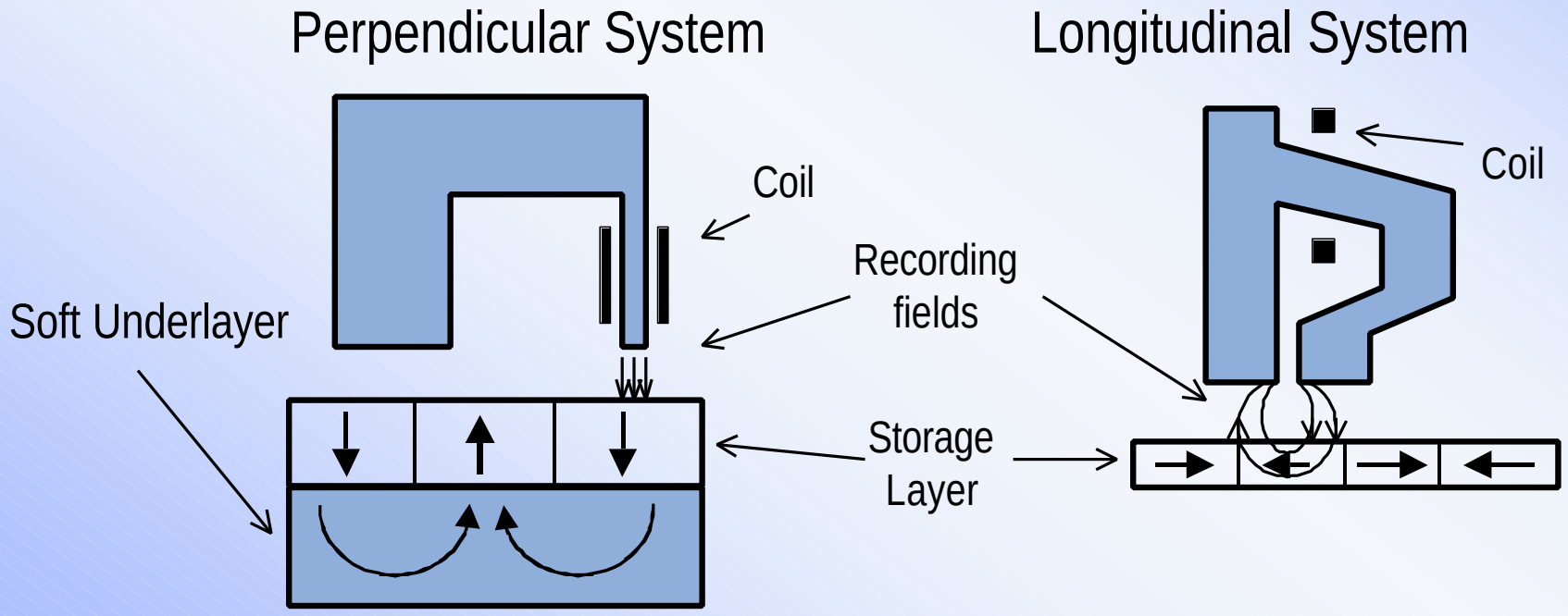
Superparamagnetism - fundamental problem !

1. Shift to smaller grains without increasing Ho **(~2x gain)**
   - **AFC media**
2. Enhance Write Efficiency **(5-10x gain)**
   - **Perpendicular Magnetic Recording**
3. Use smaller Grains&Deal with Write Field Problem **(~10x gain)**
   - **Heat Assisted Magnetic Recording (HAMR)**
4. Single Grain per Bit Recording combined with HAMR **(~5x gain)**
   - **Self Ordered magnetic Array media (SOMA)**

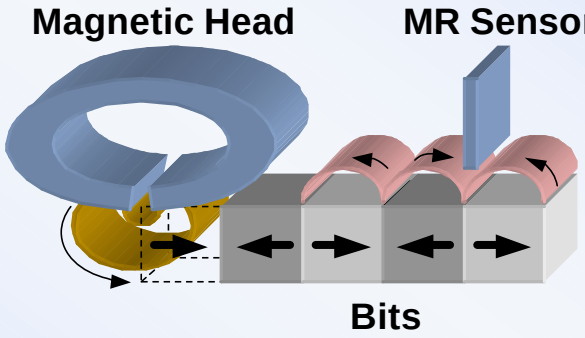
Ultimate Recording Density > 50 Tbit/in² conceivable

Perpendicular System at 1 Tbit/in^2 (NSIC)

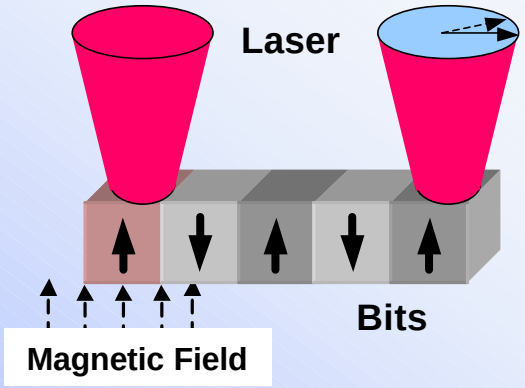
- It is believed that **~1Tbit/in^2** is possible to achieve with perpendicular magnetic recording (~ **5-10x** gain from longitudinal recording)



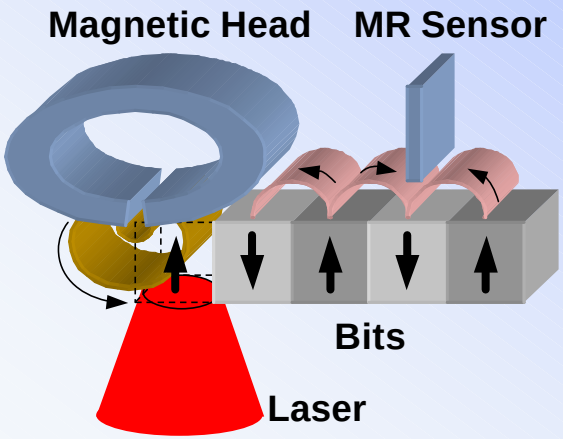
HAMR - Heat Assisted Magnetic Recording



Magnetic Recording



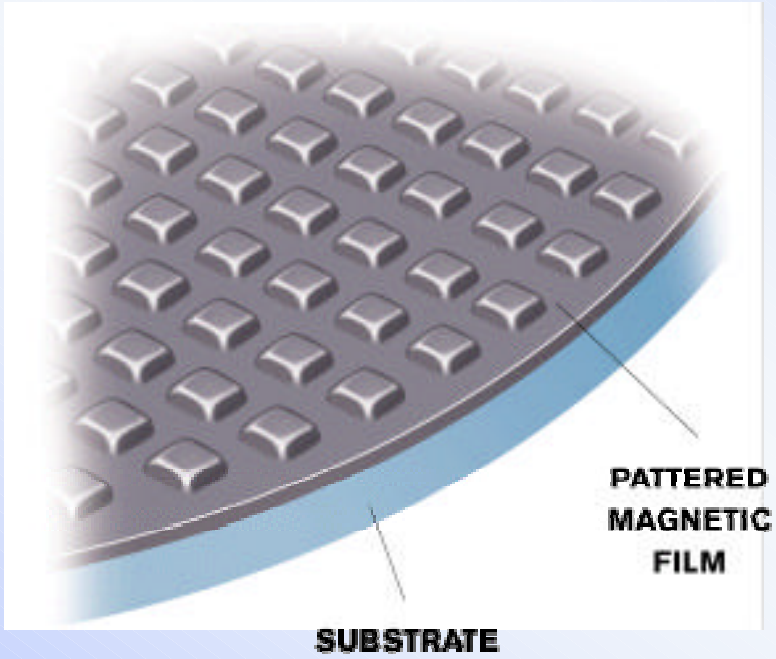
Magneto-Optical Recording

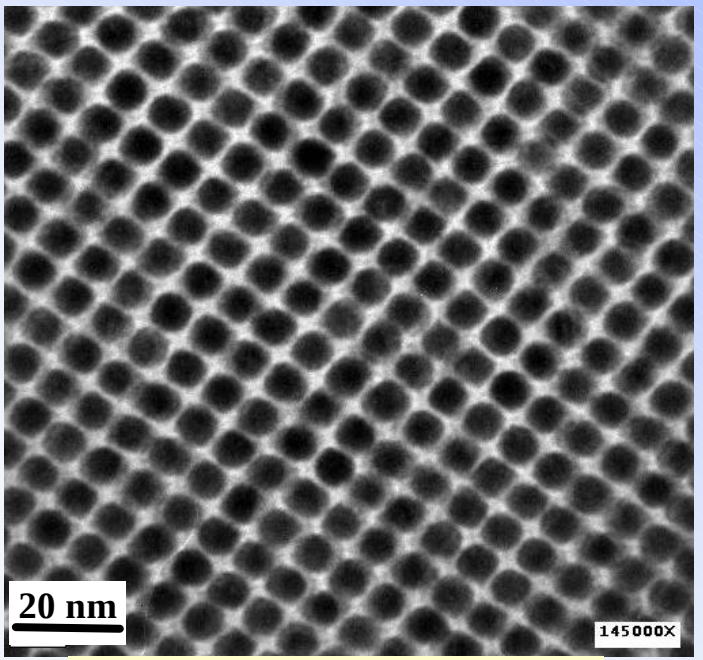


HAMR or Hybrid Recording

10Tbit/in^2 is conceivable with HAMR + polycrystalline medium (**10x** gain)

Patterned Media/Self-Ordered Magnetic Arrays





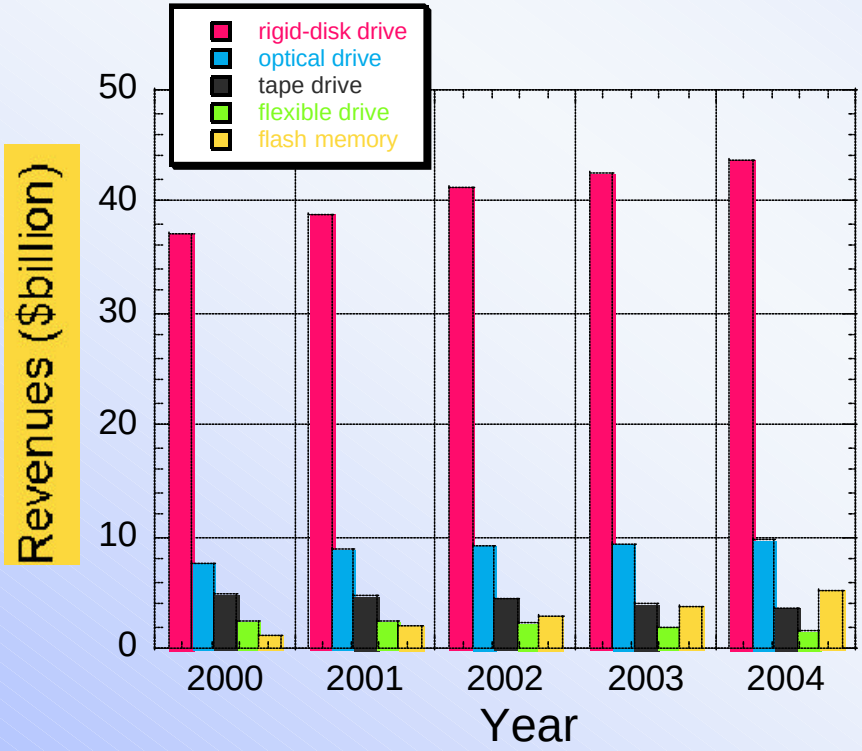
S. Sun, Ch.Murray, D. Weller, L. Folks, A. Moser, Science, 287, 1989 2000

6.3 ± 0.3 nm FePt particles

Nanoparticle arrays – 9 "Tbit/in^2"

- Major challenge is finding low cost means of making media
- Above **50Tbit/in^2** is conceivable with HAMR + Patterned Medium (**5x** gain)

Revenue Projections / Market Share Estimates



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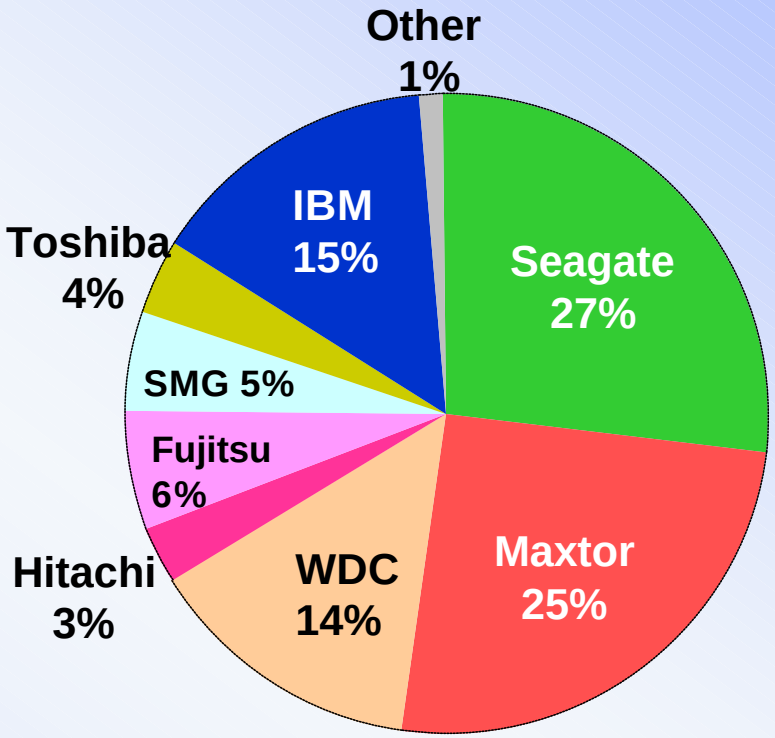

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