*Opportunities in Nanomagnetism**

Borrowed from Sam Bader

Argonne National Labs

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Argonne National Laboratory

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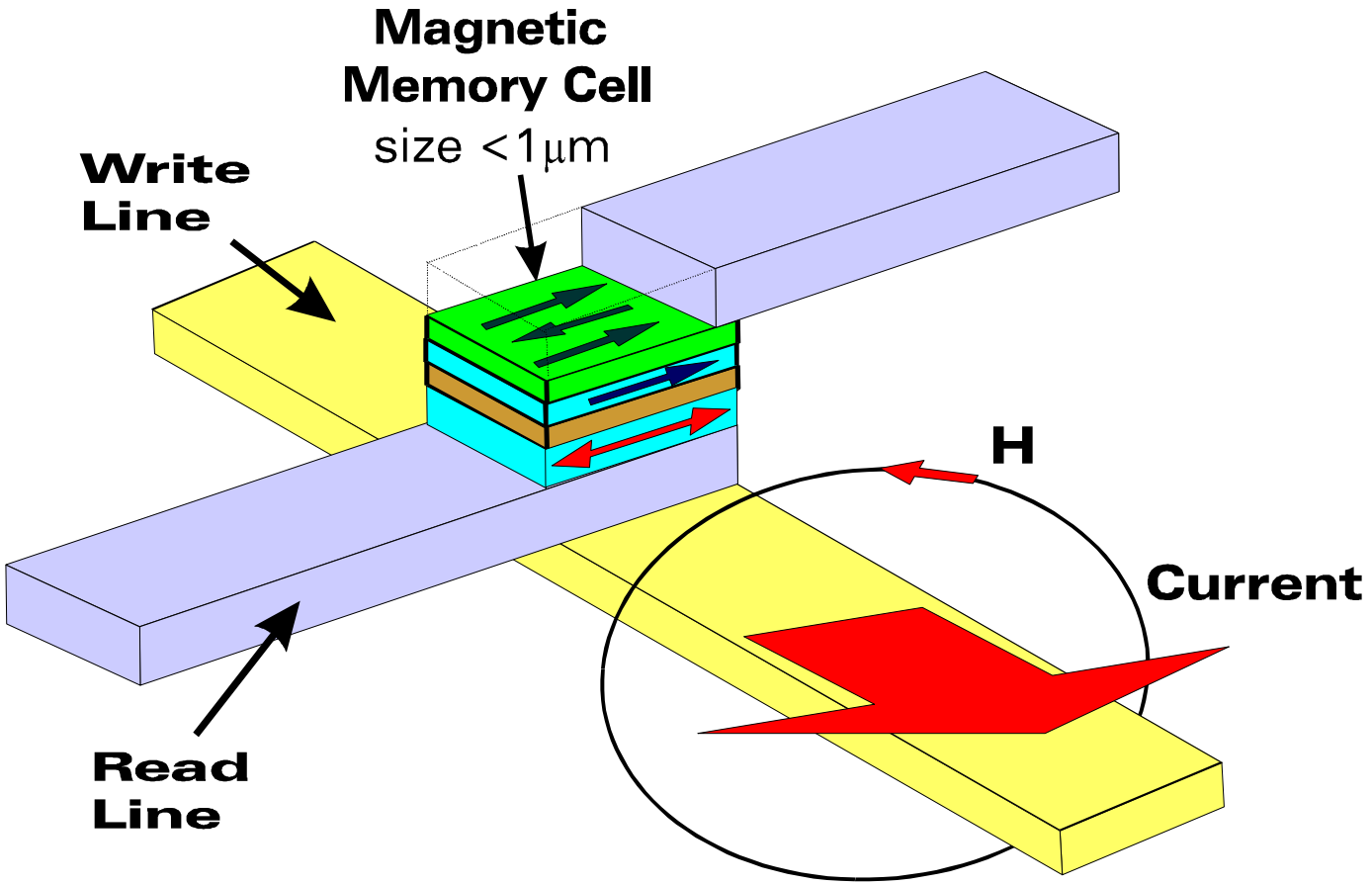
Grand Challenges in Nanomagnetism
Ultra Strong Permanent Magnets
Ultra High Density Media
Spin Transistor With Gain
~100% Spin Polarized Materials
R.T. Magnetic Semiconductors
Instant Boot-Up Computer
Magnetic Logic
Spin-Based Qubits
Hierarchically Assembled Media
Computer From Test Tube
Nano-Bio Mag Sensors

Magnetic Random Access Memory



Now in production by Freescale Semiconductor (Motorola)

http://www.freescale.com/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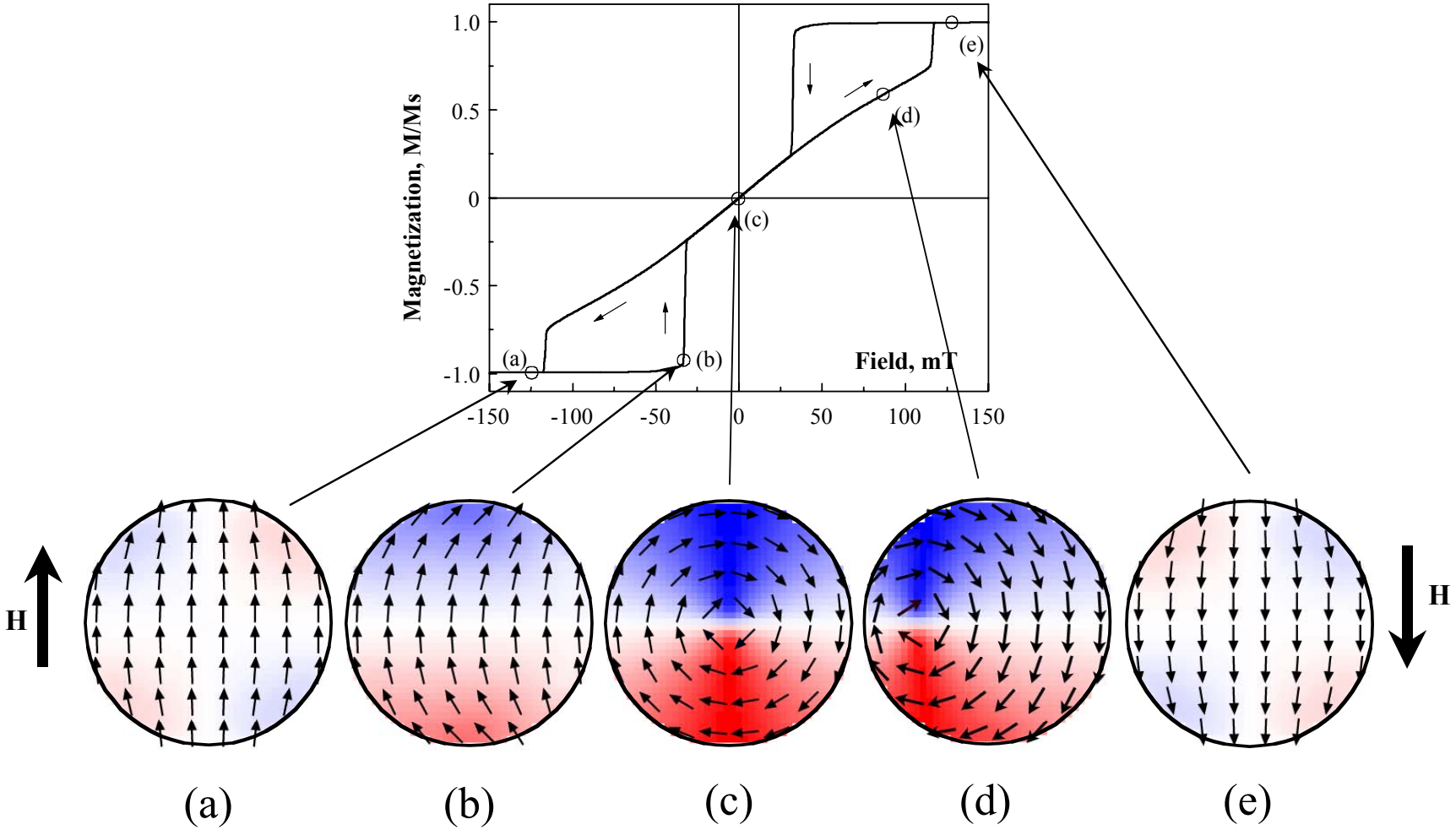
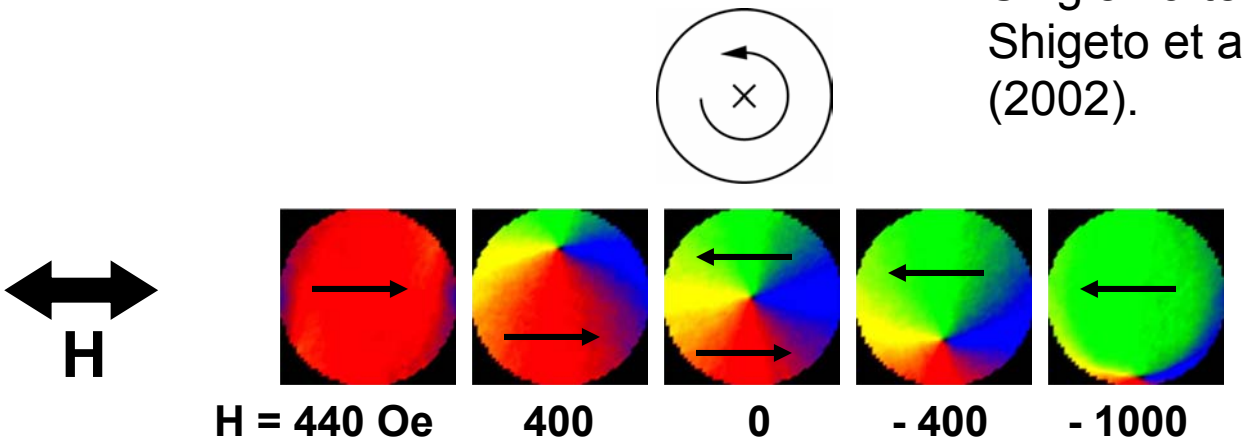
Magnetic Vortex State in Disk-shaped Nanomagnets



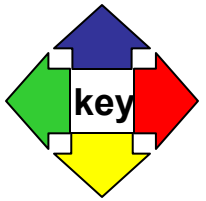
Magnetization reversal due to formation of the magnetic vortex state in circular dot

Submicron Permalloy Stadia

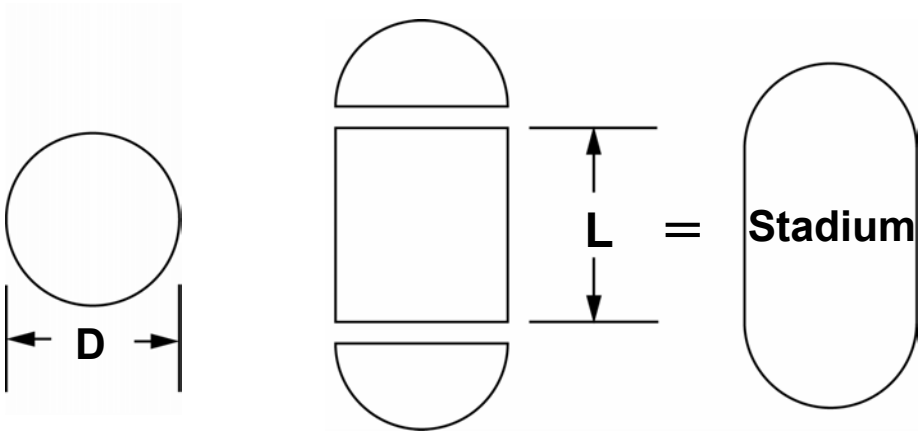
Single vortex in a dot- T. Shigeto et al., APL **80**, 4190 (2002).



Simulation

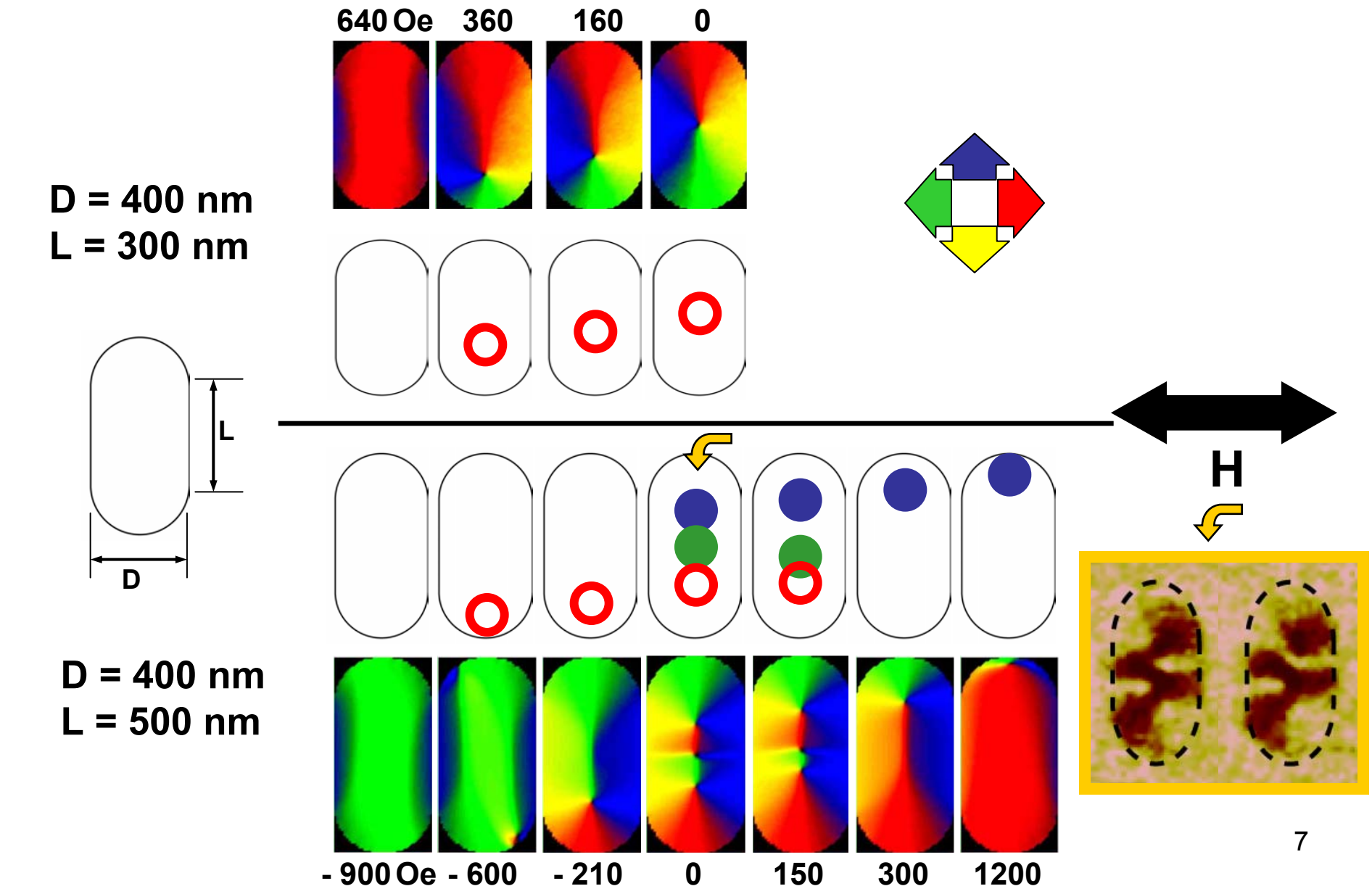


D = 400 nm

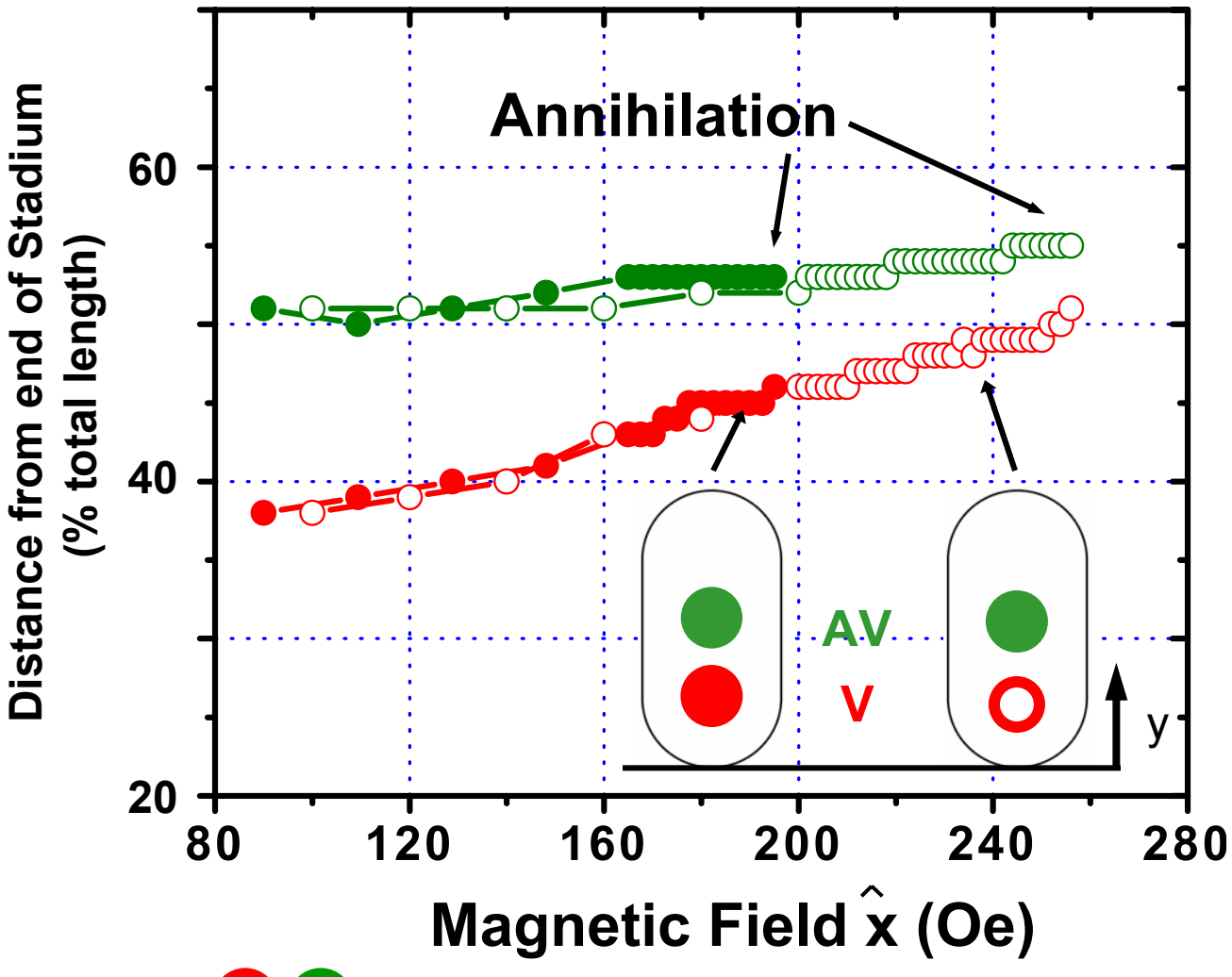


- Structures
- Nucleation
- Interactions

Virtual Particles



Core Interactions



In the reversal process, past a critical aspect ratio, vortex-antivortex pair creation facilitates the reversal.

Understanding the vortex-antivortex nucleation and annihilation is not as simple as we thought as the associated energies do not vary much so it is all hidden in the dynamics.

Cuteness factor- like field theory in stop action animation - for Casimir effect, black hole decay, and Kosterlitz-Thouless transition.