Microscopic Mechanism of Magnetic Vortex Pinning

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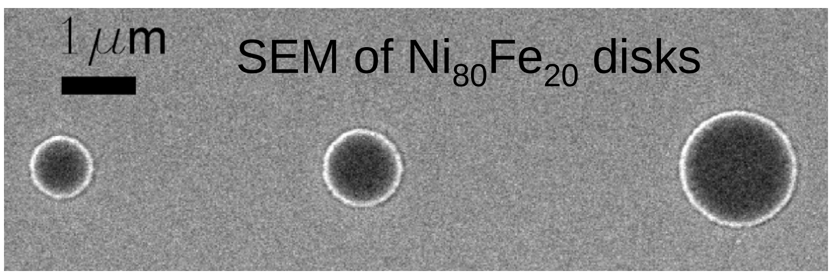
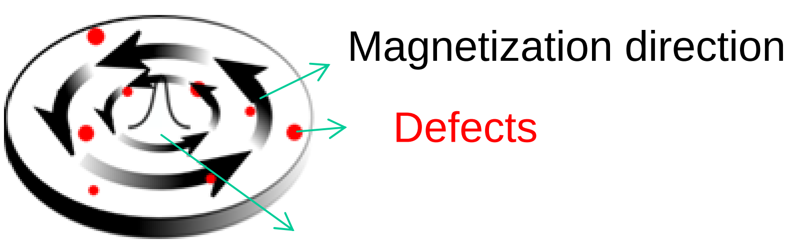
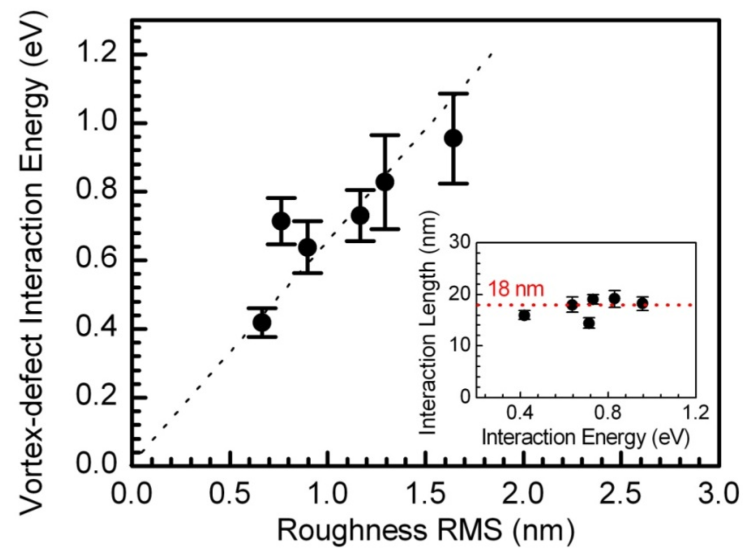
- Magnetic vortices play an important role in novel magnetic devices and in the general understanding of complex magnetic structures.
- In patterned magnetic disks, in which a single vortex is formed, we investigate how defects in materials interact with, or "pin", the magnetic vortex.





Vortex core region ~ 18 nm
(the only region where the magnetization points out of the disk plane)

- We measure the *interaction length* and the *interaction energy* between a vortex and defects:
  - The interaction length matches the size of vortex core, 18 nm, suggesting that the vortex core region is where pinning happens.
  - The interaction energy is proportional to the surface roughness, showing that roughness is the dominant mechanism of vortex pinning in $Ni_{80}Fe_{20}$ films.



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