

MAGNETISMO E SUPERCONDUTTIVITÀ

Gruppo NMR

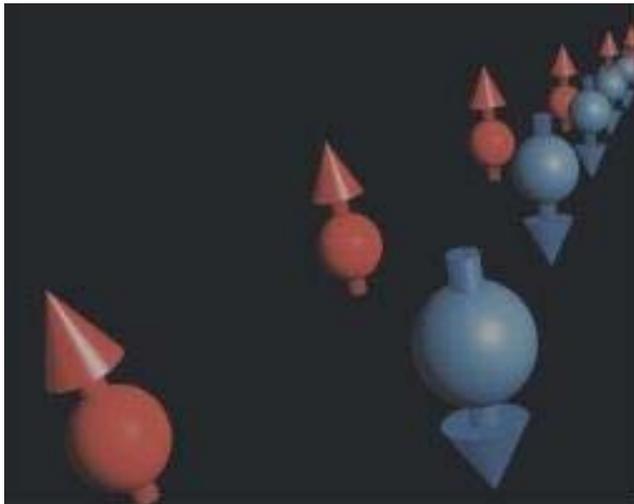
<http://nmrphysics.unipv.it>



Layout

- **Tecniche sperimentali**

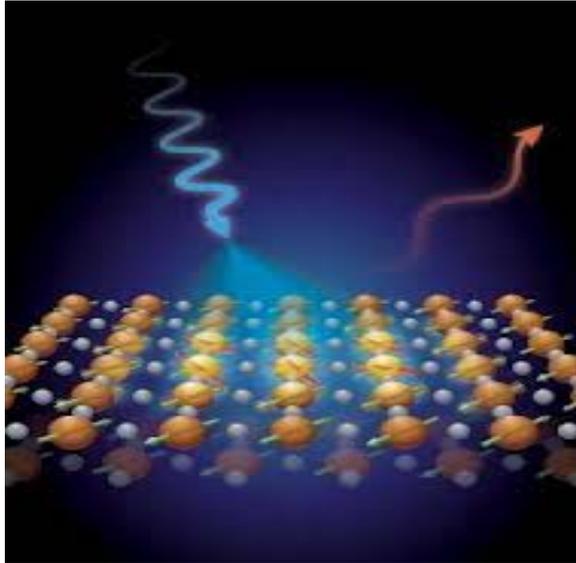
- Risonanza Magnetica (NMR, NQR e EPR)
- Spettroscopia muonica (μ SR)
- Magnetometria SQUID, trasporto, calorimetria



- **Linee di ricerca**

- Superconduttori
- Nano-magneti molecolari
- Stoccaggio dell'idrogeno

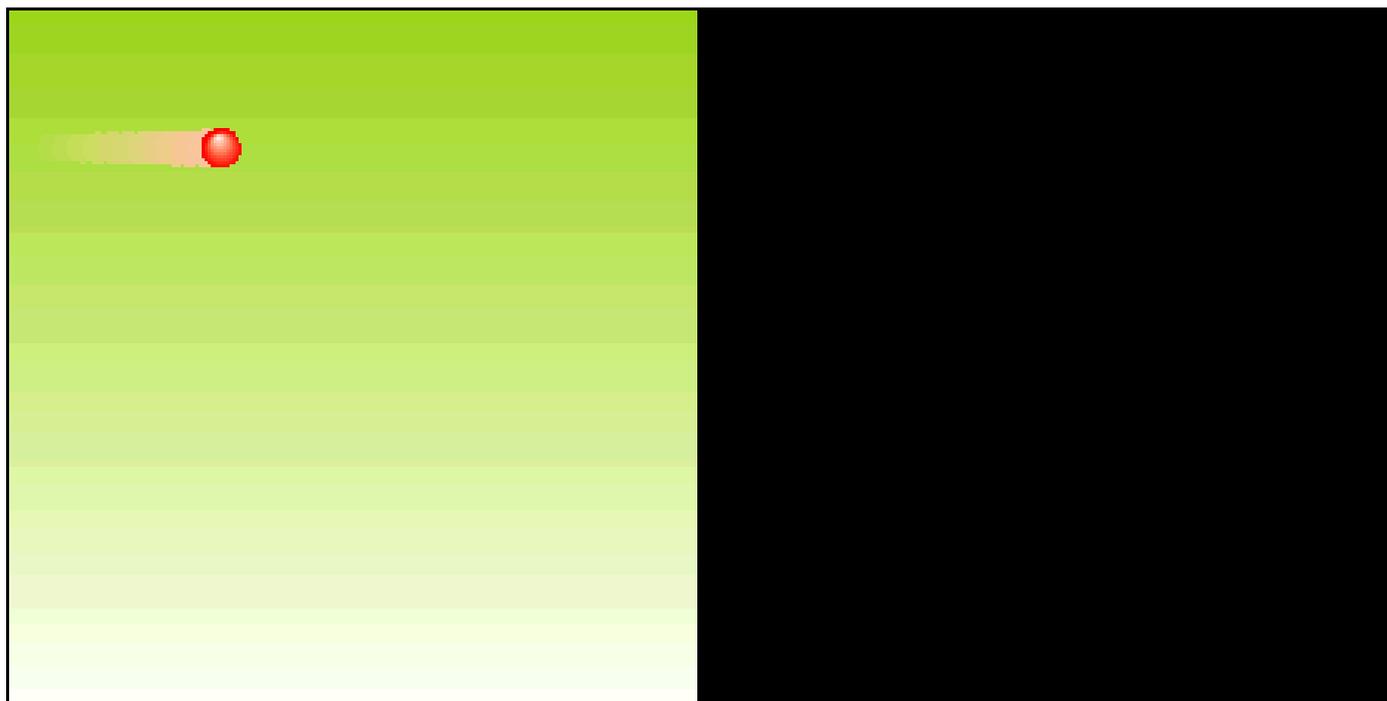
Risonanza Magnetica (NMR, NQR e EPR)



Manipolazione
quantica



Spettroscopia muonica (μ SR)

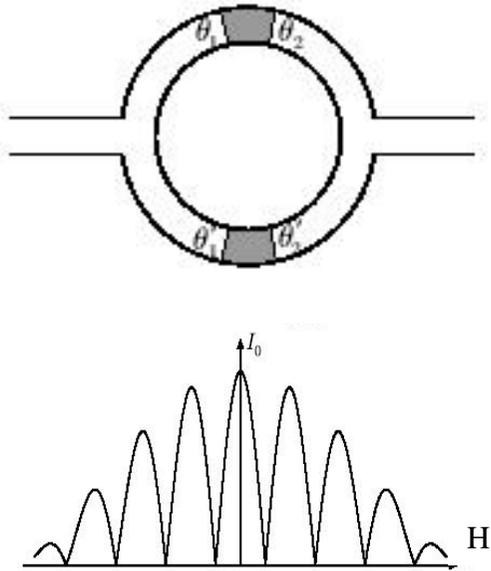


Le Large Facilities di muoni nel mondo



μ SR facilities of the world.

SQUID (Superconducting Quantum Interference Device)



Interferenza quantica di funzioni
d'onda superconduttive



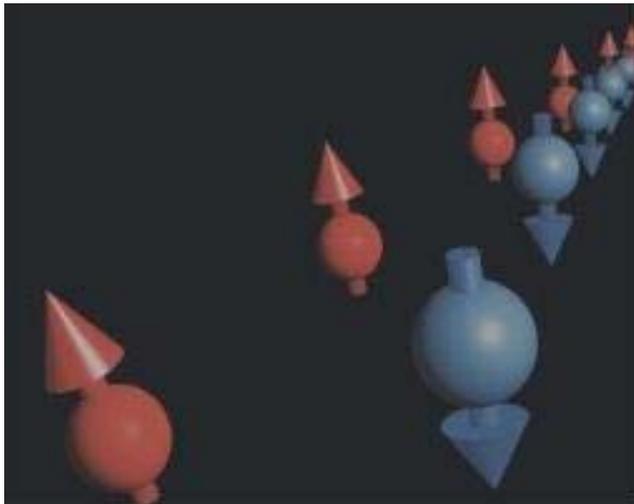
$$\mu_0 H_{\min} \sim 10^{-15} \text{ Tesla}$$

Elevata sensibilità!

Layout

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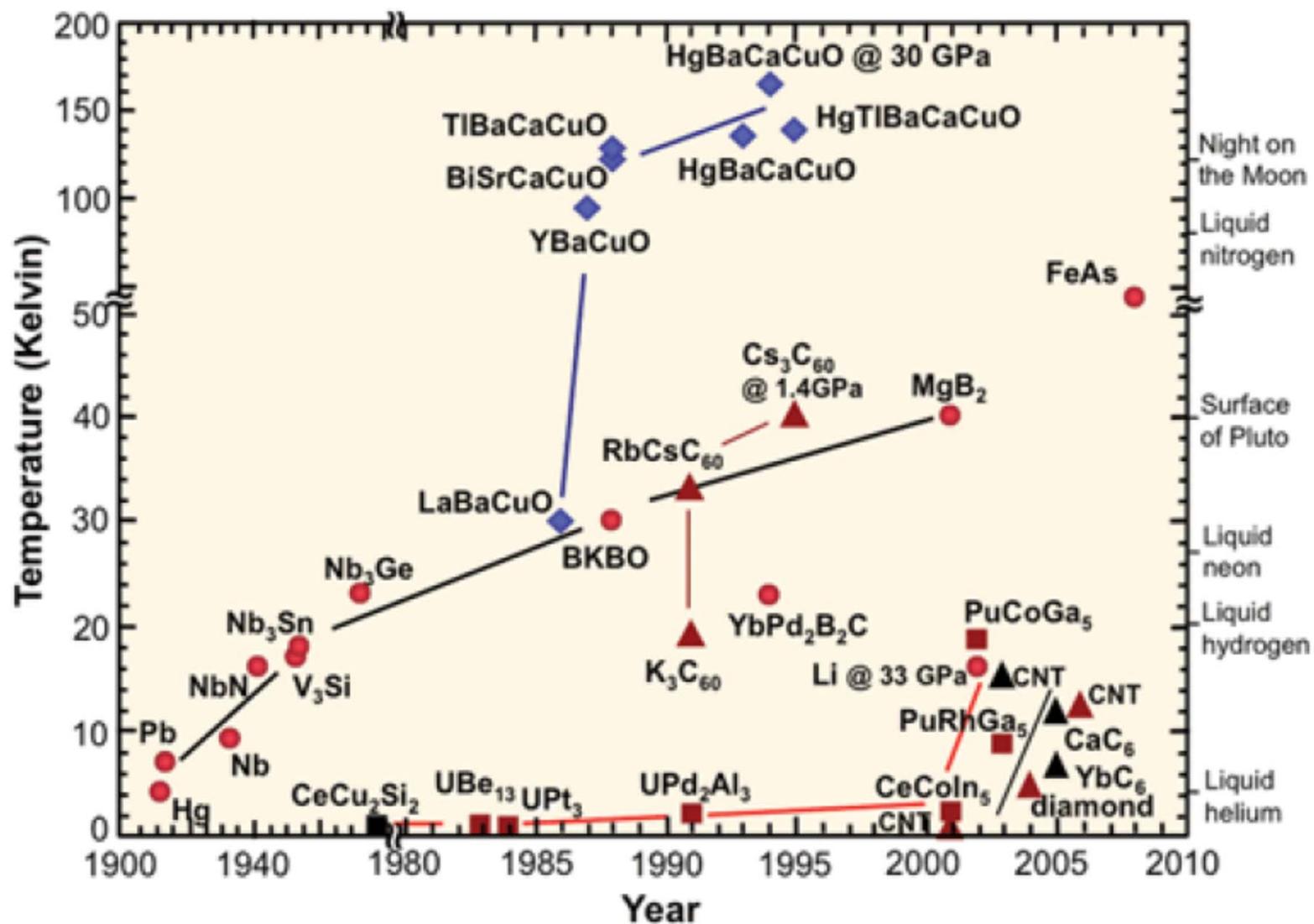
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- **Stoccaggio dell'idrogeno**

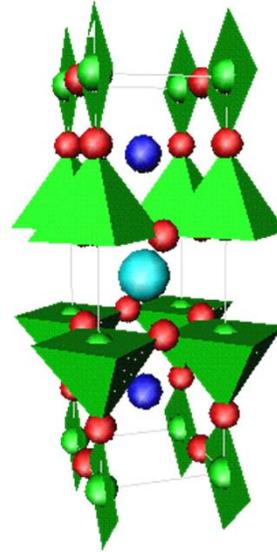
Superconduttori



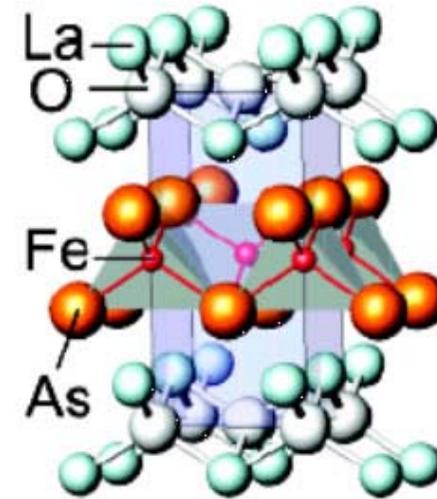
Superconduttori



**Quale meccanismo
microscopico genera lo
stato superconduttivo?**

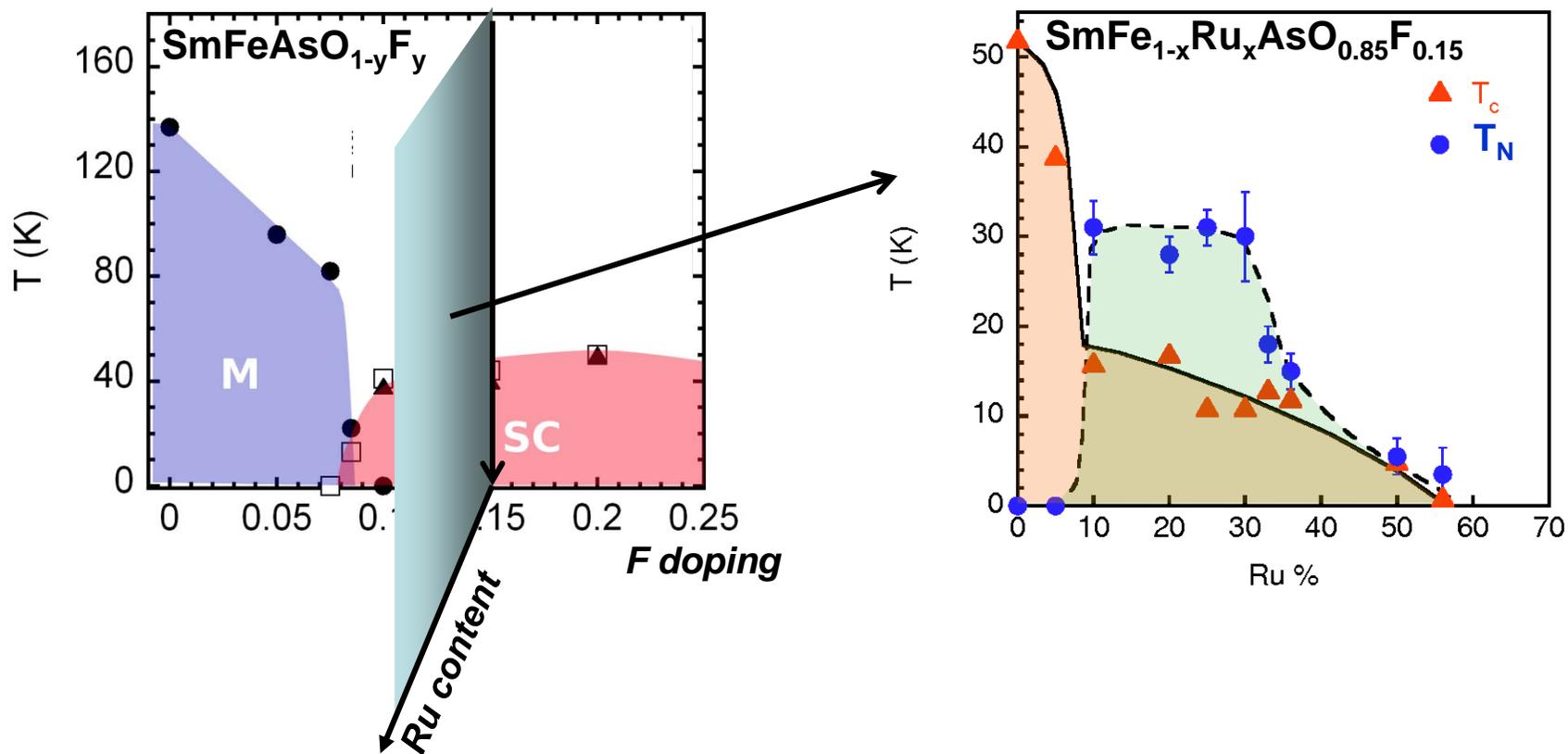


$\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$



LaFeAsO

Superconduttività e magnetismo

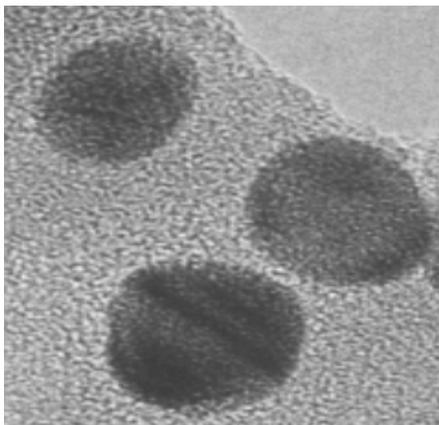


Il magnetismo è spesso prossimo alla superconduttività e/o coesiste con essa

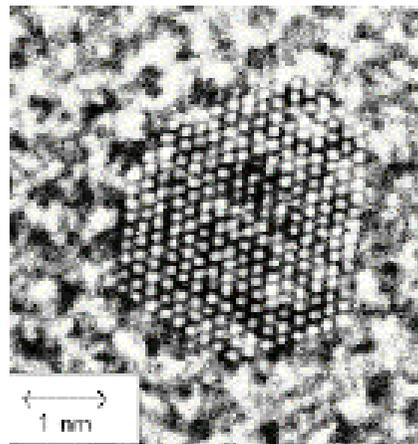
Nano-magneti molecolari

| Nanoparticles | Clusters | Nanomagnets | Atoms | |
|---------------|-------------|-------------|-------|------|
| $10^5 - 2$ | $10^3 - 10$ | 20-1 | 0.1 | (nm) |

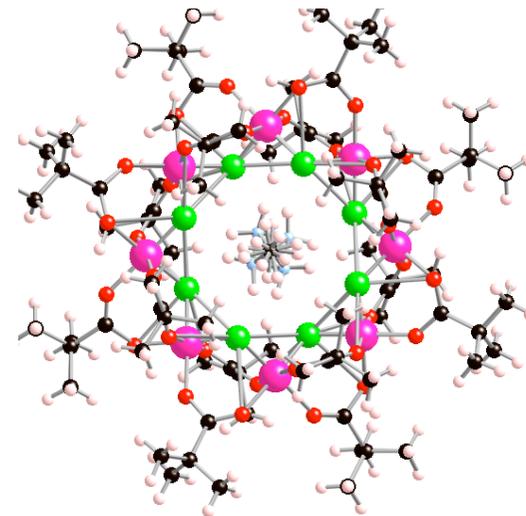
← 30 nm →



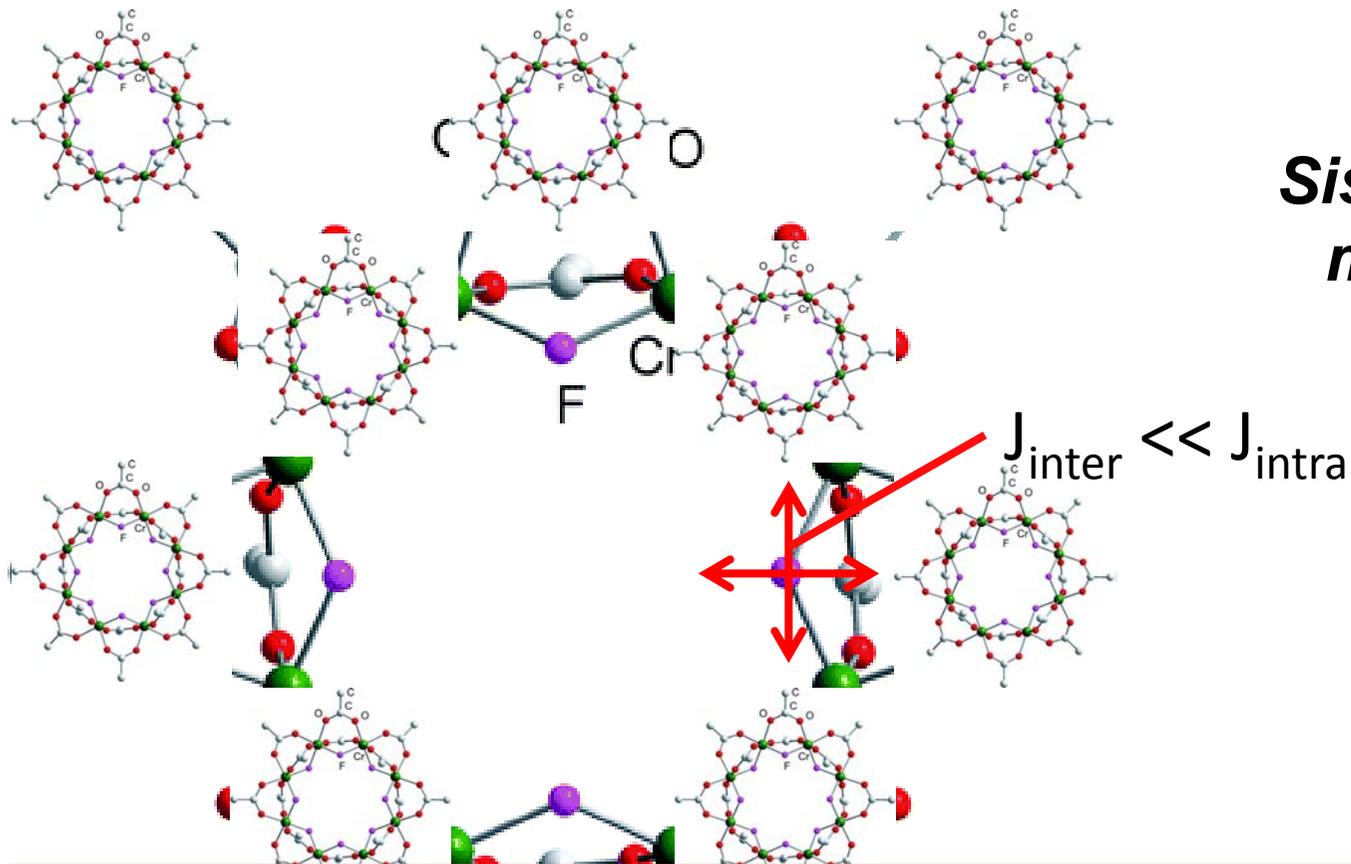
← 5 nm →



← ~1 nm →

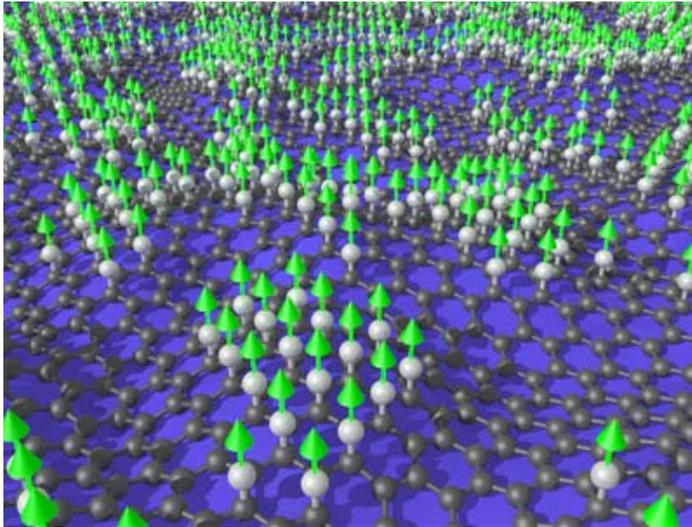
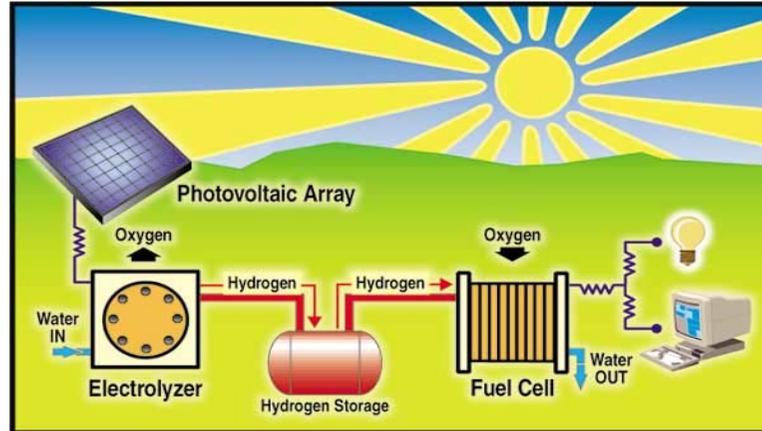


Nano-magneti molecolari



- *Stato fondamentale di magneti 0D*
- *Tempi di decoerenza – processi di tunneling*
- *Accoppiamento in cavità e in conduttori organici*

Nanostrutture di Carbonio per H storage



- Quantità di H accumulato
- Presenza di differenti configurazioni locali
- Studio dei processi diffusivi dell'idrogeno



Permanent Staff

- Pietro Carretta
- Maurizio Corti
- Alessandro Lascialfari
- Samuele Sanna
- Marco Moscardini

Post-docs

- Luca Maidich
- Tomas Orlando
- Fulvia Palesi

PhD students

- Fatemeh Adelnia
- Marco Cobianci
- Matteo Moroni

Undergraduate

- Filippo Caracciolo

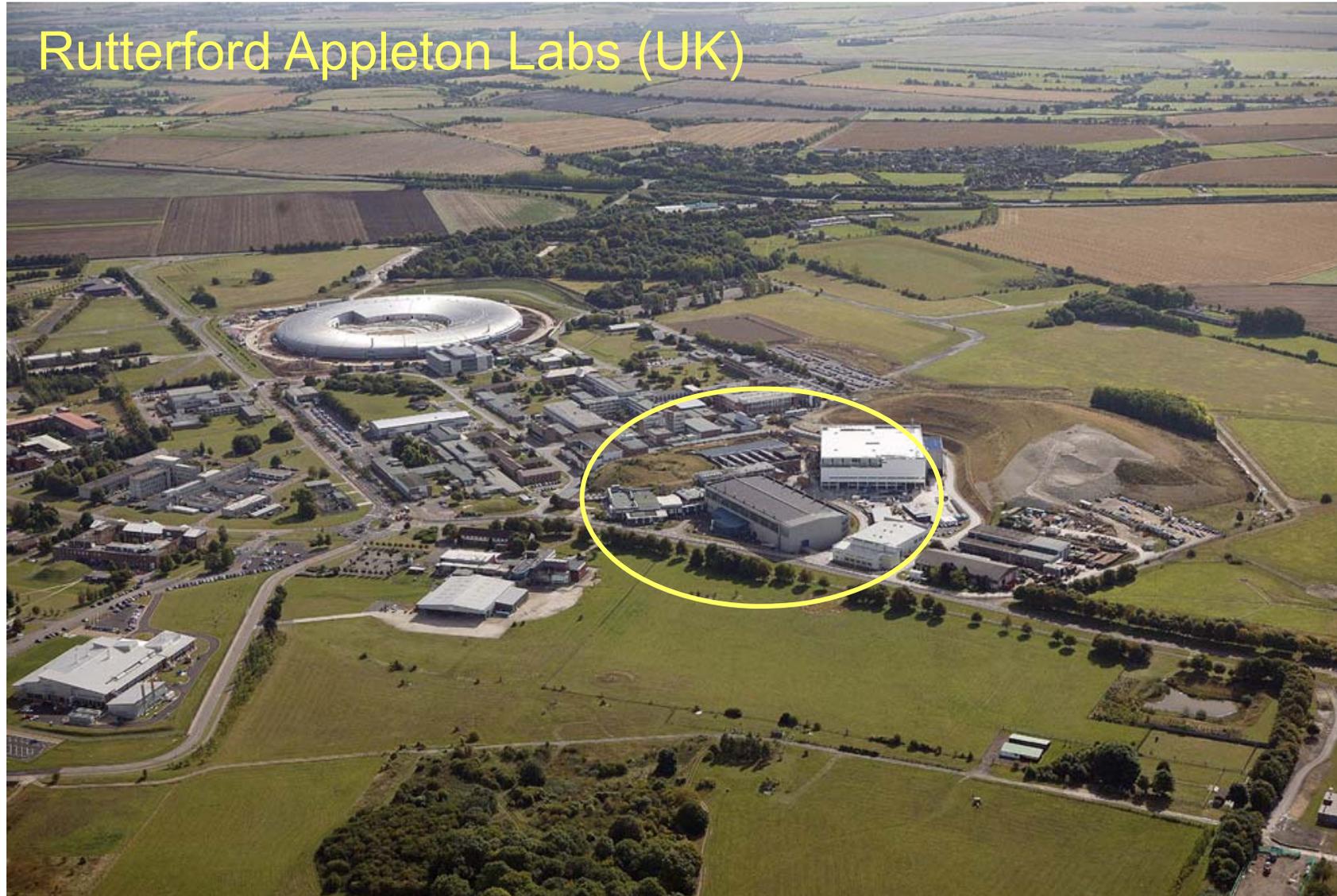
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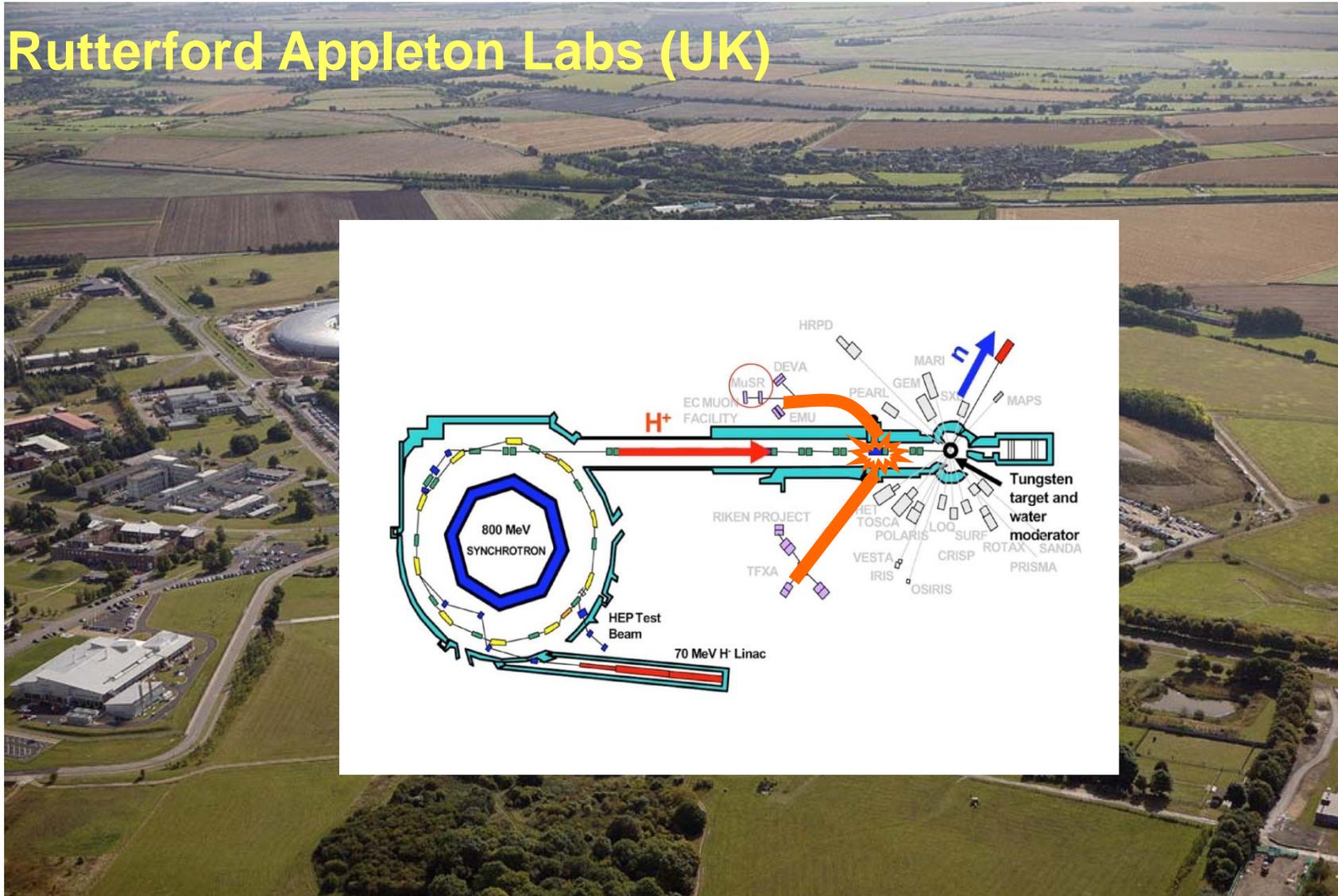


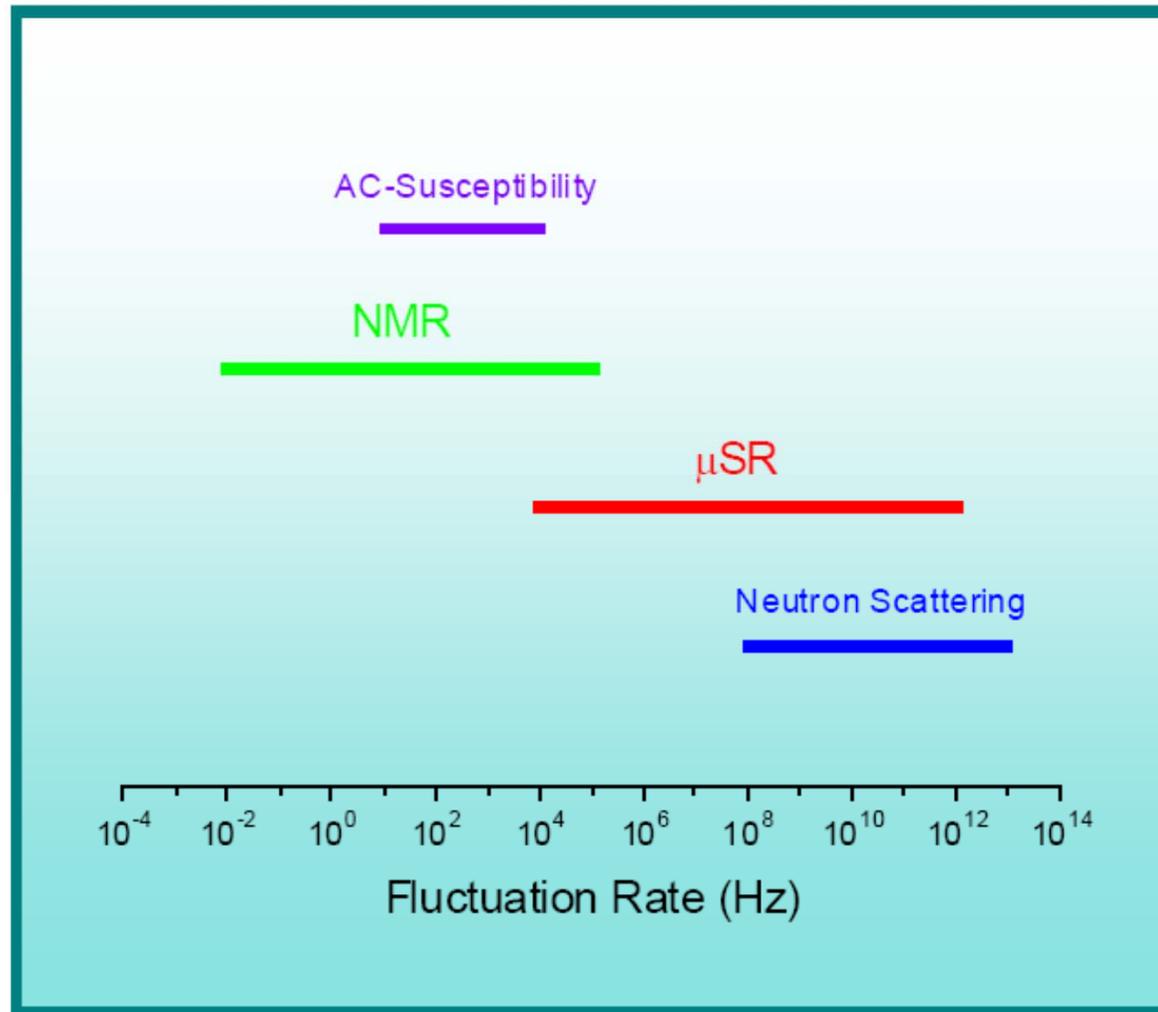
Le Large Facilities di muoni



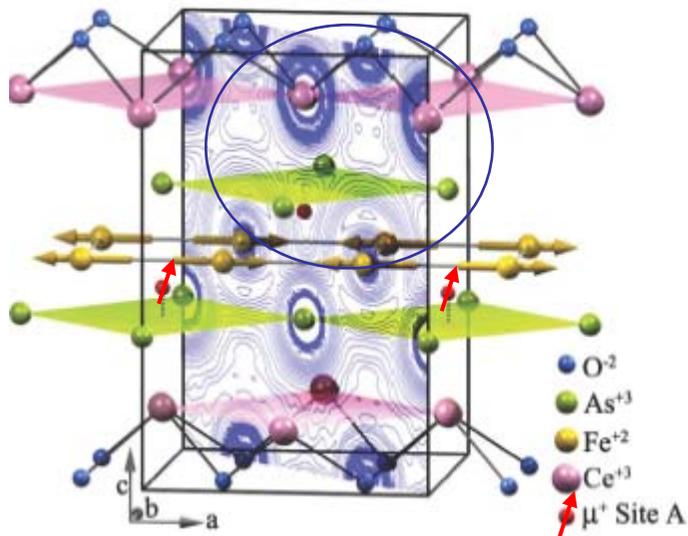
Le Large Facilities di muoni

Rutherford Appleton Labs (UK)



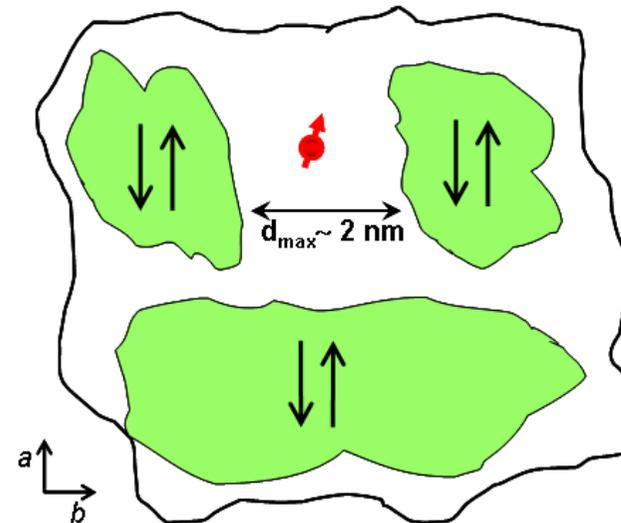


Superconduttività e magnetismo



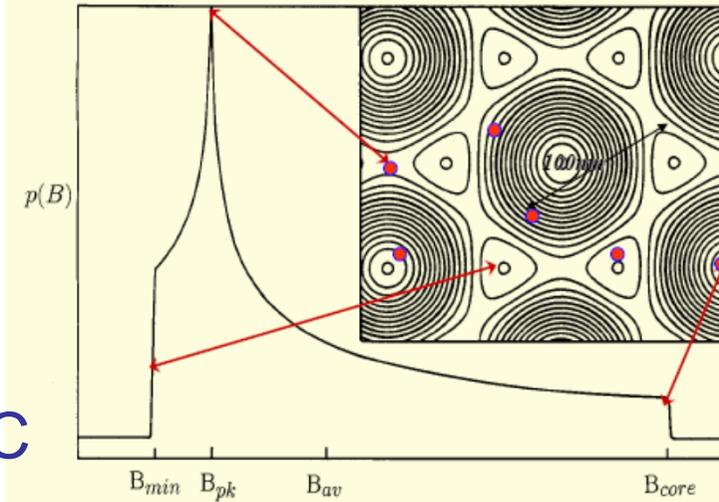
range of hyperfine interaction ~ 1 nm

\Rightarrow *local probe*



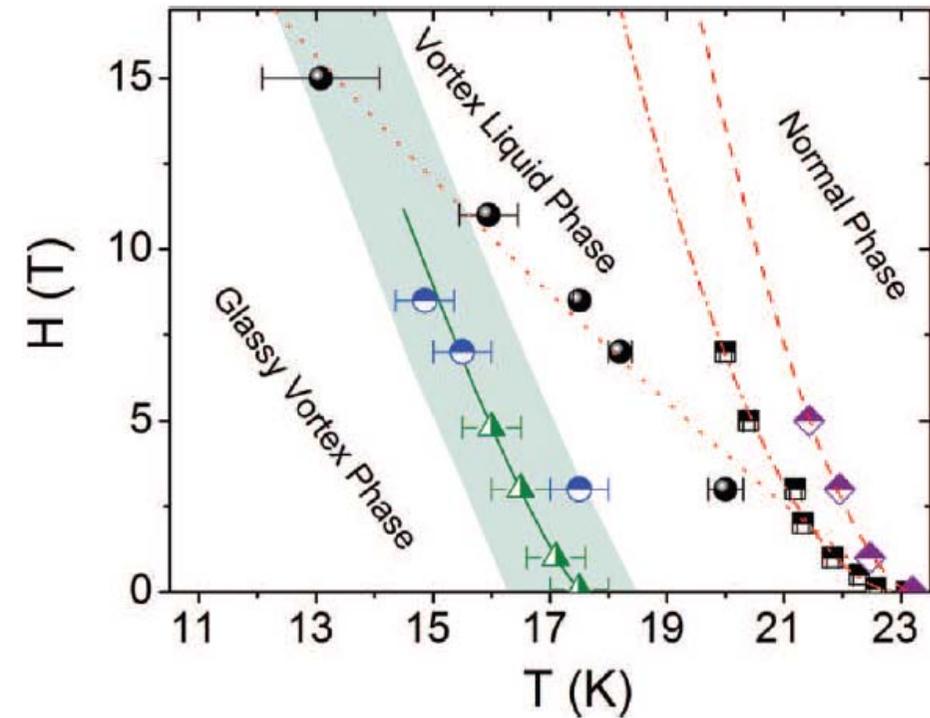
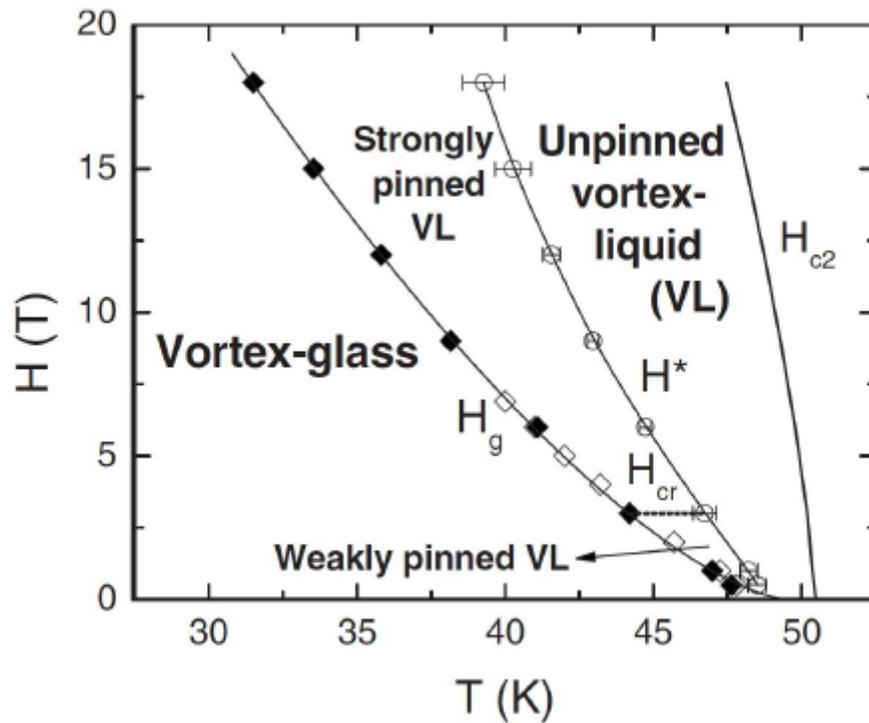
All the muons detect *static* magnetic moments if the *maximum distance* between AF magnetic domains is $\sim 2-4$ nm

Diagramma di fase H-T

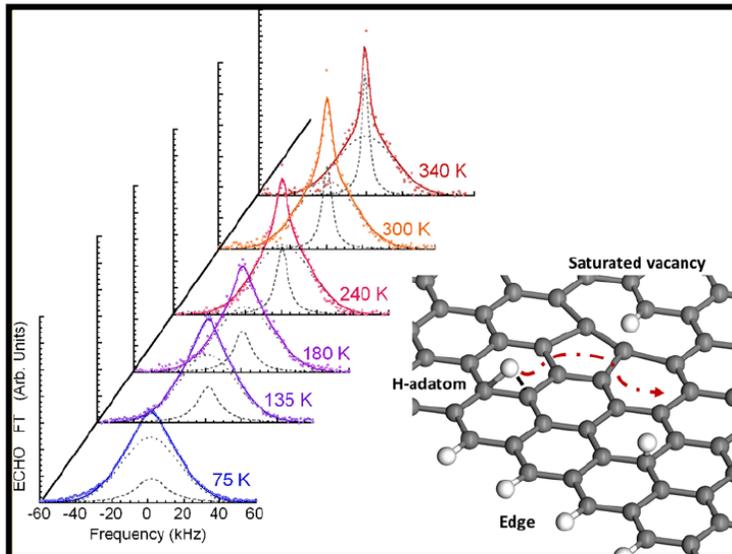
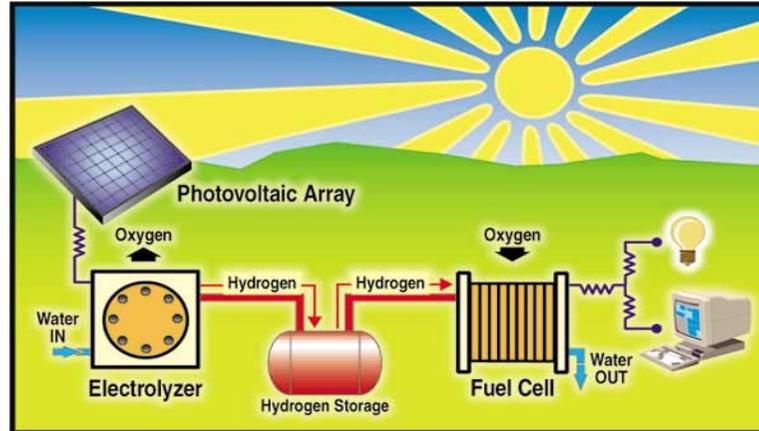


Cuprate SC

Fe-based SC



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