

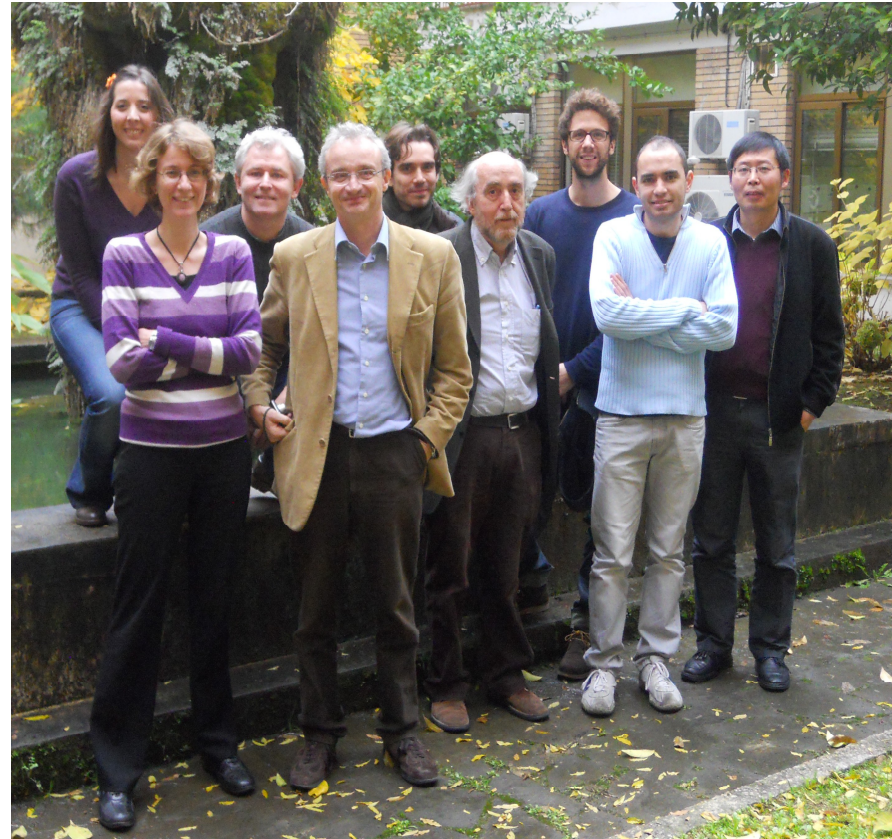
SAPIENZA  
UNIVERSITÀ DI ROMA

# Unità di Ricerca Roma La Sapienza

Incontro del 13 giugno 2012

# Persone (il gruppo CLC)

- Sergio Caprara
- Claudio Castellani
- Carlo Di Castro
- Marco Grilli
- Lara Benfatto
- José Lorenzana
- Valentina Brosco, Daniel Bucheli,  
Matteo Capati, Laura Fanfarillo,  
Zujian Ying
- B. A. Aronzon, N. Bergeal,  
E. V. Chulkov, P. M. Echenique,  
T. Giamarchi, R. Hackl, E. Kulatov, G. Lemarie,  
J. Lesueur, P. Raychaudhuri, V. V. Rylkov,  
G. Seibold, V. V. Tugushev, ...



# Linee di ricerca

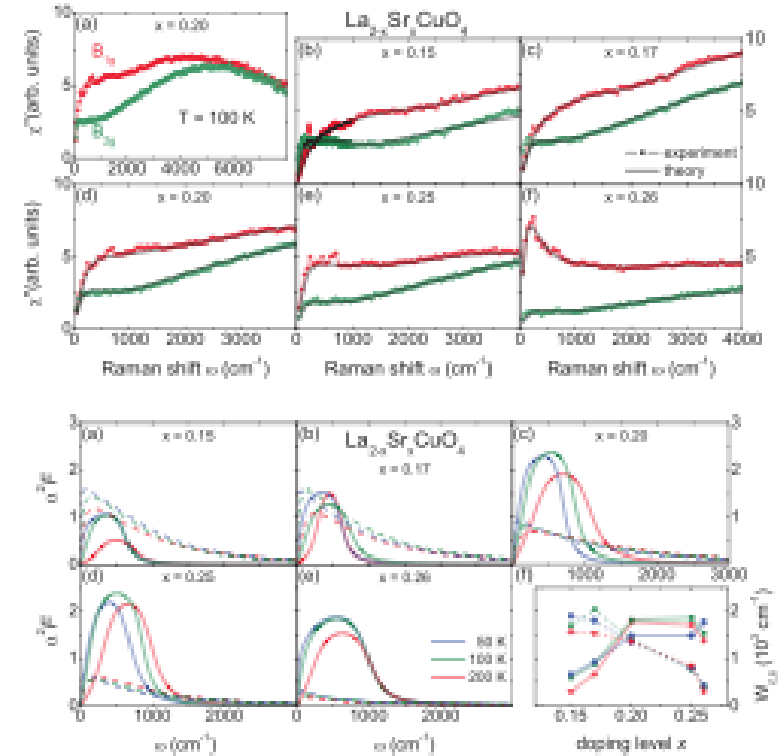
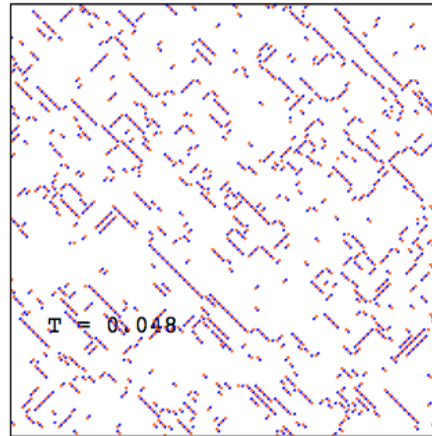
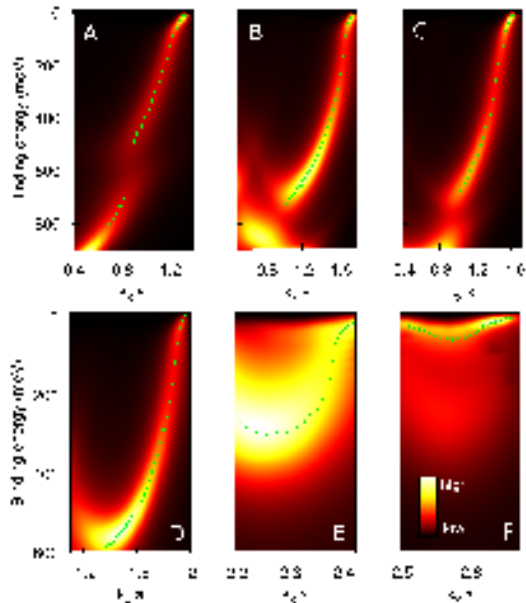
- Superconduttività (ad alta temperatura)
- Sistemi elettronici fortemente correlati
- Interazione elettrone-fonone
- Fenomeni critici (quantistici)
- Sistemi disordinati
- Materiali complessi
- Spintronica
- Teoria del funzionale densità



# Superconduttori ad alta $T_c$

## Cuprati

- Scenario del punto critico quantistico (Raman, ARPES)
- Fase Stripe
- Fase Nematica



- S. Caprara, C. Di Castro, M. Grilli
- J. Lorenzana
- M. Capati
- G. Seibold (Cottbus)
- Experiments: R. Hackl (Muenchen)

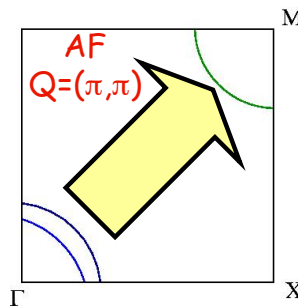


# Pnicturi, Diboruri, ...

- Sergio Caprara, Claudio Castellani, Emmanuele Cappelluti (CNR)
- Lara Benfatto (CNR)
- Laura Fanfarillo (PhD)
- Peculiarità dei sistemi multibanda
- Approccio di Eliashberg per sistemi multibanda. Nuova fisica da interazioni dominanti interbanda tra portatori di tipo elettrone e buca.

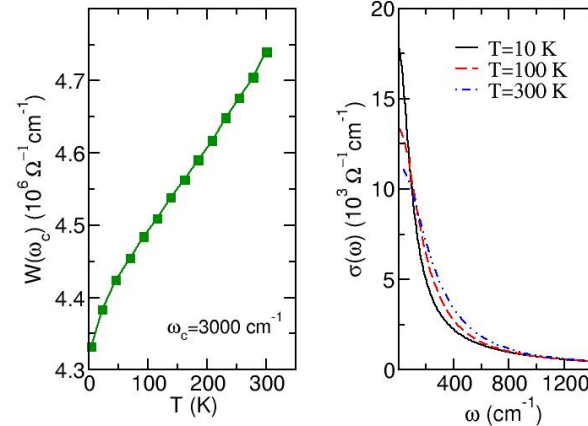
Applicazioni a:

- ARPES
- Regola di somma per la conducibilità ottica
- Effetto Hall

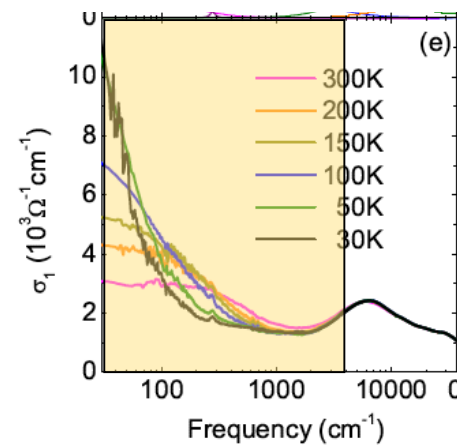


Publlicazioni recenti:

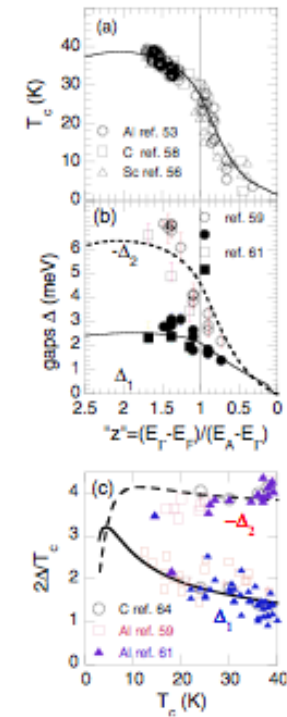
- L. Benfatto, E. Cappelluti and C. Castellani, [Phys. Rev. B 80, 214522 \(2009\)](#).
- L. Benfatto and E. Cappelluti, [Phys. Rev. B 83, 104516 \(2011\)](#).
- L. Fanfarillo, E. Cappelluti, C. Castellani, L. Benfatto, [arXiv:1205.2242](#)



Aumento anomalo del peso spettrale  
PRB 83, 104516 (2011)

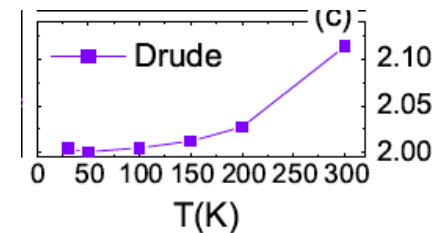


D. Wu et al. PRB 83, 100503 (11)



MgB<sub>2</sub>

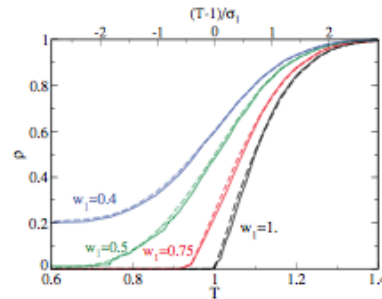
EuFe<sub>2</sub>(As<sub>0.82</sub>P<sub>0.18</sub>)<sub>2</sub>



# Superconduttori disordinati

- Sergio Caprara, Claudio Castellani, Marco Grilli
- Lara Benfatto (CNR), José Lorenzana (CNR)
- Daniel Bucheli (PhD student)
- Gabriel Lemarie (Toulouse), Goetz Seibold (Cottbus), Thierry Giamarchi (Geneva)
- **Experiments:** Pratap Raychaudhuri (TIFR Mumbai, India)

## Effective Medium Theory

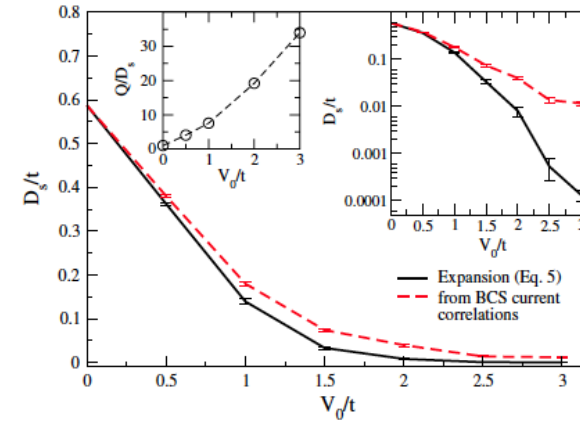


- Transizione Superconduttore-Isolante (SIT) nel modello di Hubbard disordinato
  - Ruolo delle fluttuazioni di fase vicino alla SIT
  - Fisica vetrosa e scaling universale della distribuzione del parametro

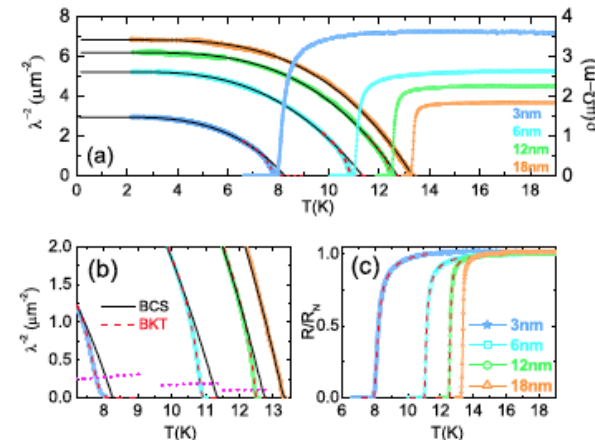
## Fisica Kosterlitz-Thouless in film quasi 2D

## Pubblicazioni

- L. Benfatto, C. Castellani, and T. Giamarchi, [arXiv:1201.2307](https://arxiv.org/abs/1201.2307)
- G. Seibold, *et al.* [Phys. Rev. Lett. 108, 207004 \(2012\)](https://doi.org/10.1126/science.1220000).
- Mintu Mondal, *et al.* [Phys. Rev. Lett. 107, 217003 \(2011\)](https://doi.org/10.1126/science.1210000)
- Mintu Mondal, *et al.* [Phys. Rev. Lett. 106, 047001 \(2011\)](https://doi.org/10.1126/science.1200000).



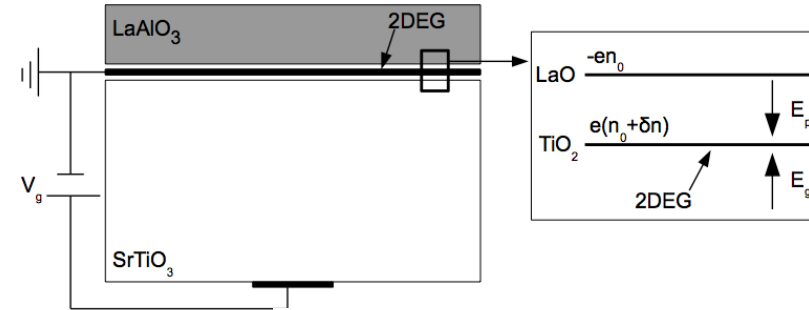
Soppressione della densità di superfluido oltre il dirty-BCS vicino alla SIT  
PRL 108, 207004 (2012)



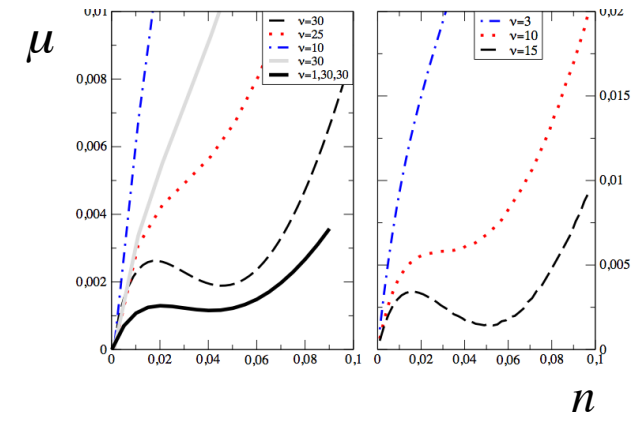
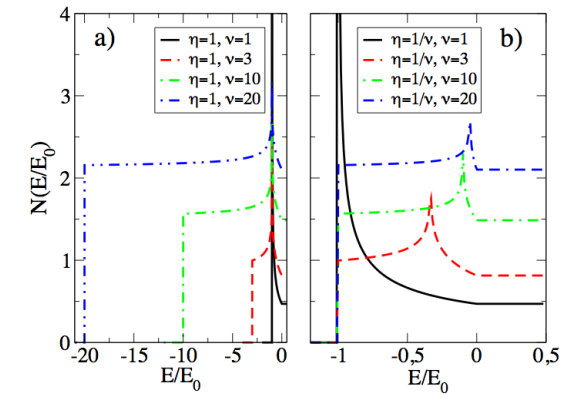
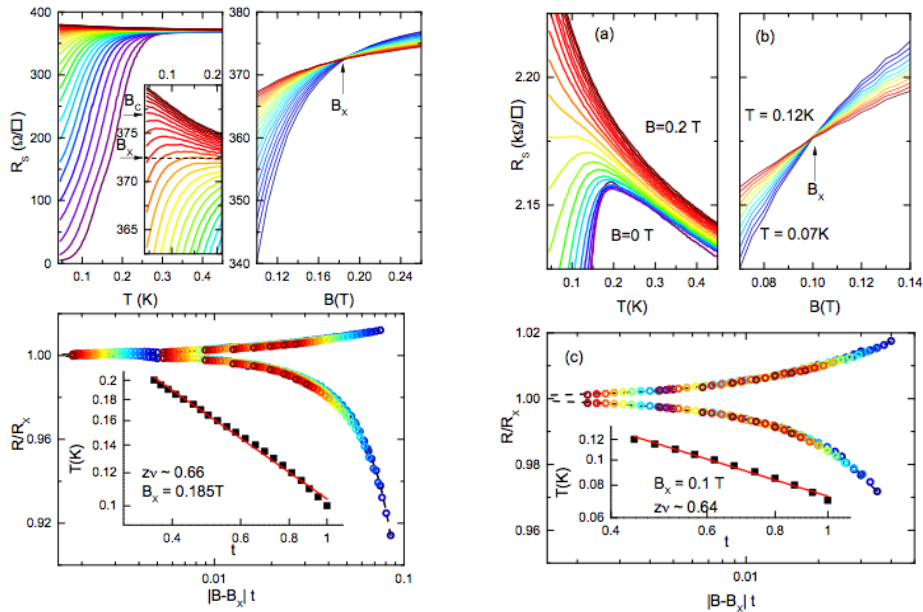
Densità di Superfluido in film di NbN films: le linee tratteggiate sono fit con la teoria BKT + inomogeneità  
PRL 107, 217003 (2011)

# Interfacce

- LAO/STO
- Instabilità intrinseca
- Superconduttività Multibanda
- Transizione superconduttore-metallo debolmente localizzato



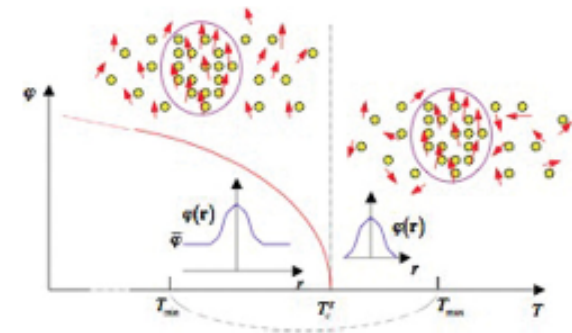
- S. Caprara, M. Grilli
- Experiments: J. Lesueur, N. Bergeal (ESPCI Paris)



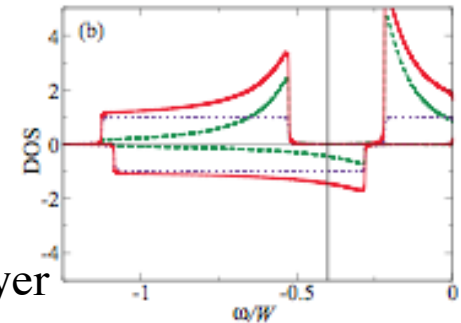
# Spintronica

- S. Caprara, M. Grilli
- V. V. Tugushev, E. Kulatov (Moscow)
- E. V. Chulkov, P. M. Echenique (DIPC S. Sebastián)
- **Experiments:** B. A. Aronzon, V. V. Rylkov (Moscow)

- Semiconduttori magnetici diluiti
- Eterostrutture magnetiche (periodiche)
- Effetto Hall anomalo
- Struttura a bande (DFT)
- Isolanti topologici



Mn  $\delta$  layer



SiMn

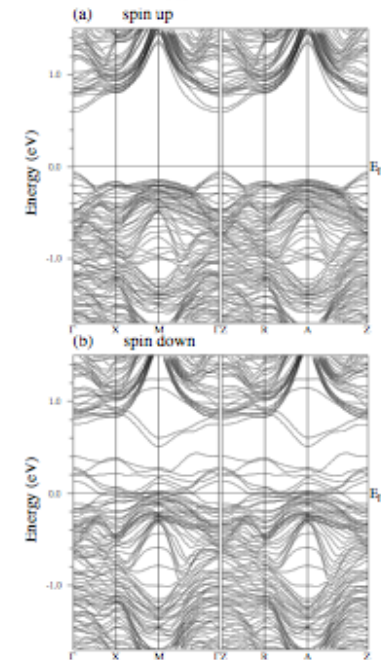
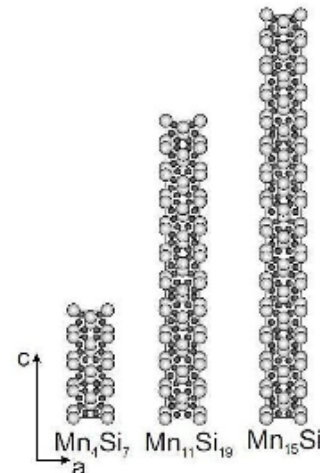
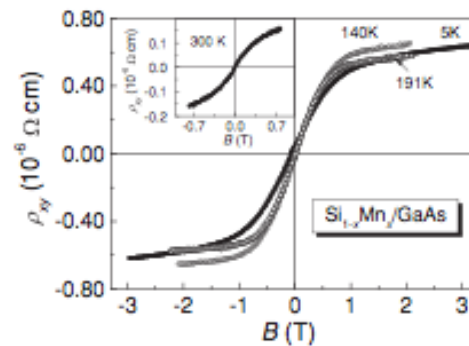
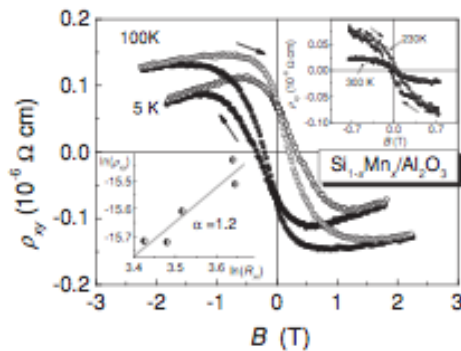


Fig. 10. Same as in fig. 7 but for  $\text{Mn}_{15}\text{Si}_{25}\text{O}_1$