Mini-rencontre du GDR Meeticc

Vendredi 02 avril 2021
De 13h30 à 15h30

Le lien générique pour vous inscrire à la réunion du 2 avril est le suivant :

https://zoom.us/meeting/register/tJIvf-CrpzwuHdfDvUstKw2t9Qvw9kQcjrvs

Après avoir cliqué sur ce lien et renseigner vos noms et adresse e-mail vous recevrez un e-mail de confirmation contenant les instructions pour rejoindre la réunion.

Programme

*Animateur : Pierre **RODIERE**, Institut Néel, Grenoble.

	Exposé (30 min + 10 min)
13:30 – 14:10	**Wide critical fluctuations of the field-induced phase transition in graphite** Benoit FAUQUE Institut de Physique, Collège de France, Paris
14:10 – 14:50	***Pause / discussion libre***
	Exposés (15 min + 5 min)
14:30 – 14:50	**Photo-emission signatures of coherence breakdown in Kondo alloys** Bishal POUDEL Laboratoires Ondes et Matière d'Aquiataine, Bordeaux
14:50 – 15:10	**Finding Dirac fermions by optical and magneto-optical spectroscopy in the nodal line semimetal $BaNiS_2$** David SANTOS-COTTIN Université de Fribourg, Suisse
15:10 – 15:30	**Fractionalized pair Density Wave and pseudogap in cuprates superconductors** Maxence GRANDADAM Institut de Physique Théorique, CEA, Paris-Saclay.

First NAME : Benoît	last NAME : Fauqué
Affiliation : IPCDF	

Presentation type : *Long (30 min)*	Talk given in : *French* (please prepare the of the presentation in english)
I authorize the GDR to record a video of my presentation : *YES*	

Wide critical fluctuations of the field-induced phase transition in graphite

In the immediate vicinity of the critical temperature (T_c) of a phase transition, there are fluctuations of the order parameter, which reside beyond the mean-field approximation. Such critical fluctuations usually occur in a very narrow temperature window in contrast to Gaussian fluctuations. Here, we report on a study of specific heat in graphite subject to high magnetic field when all carriers are confined in the lowest Landau levels. The observation of a BCS-like specific heat jump in both temperature and field sweeps establishes that the phase transition discovered decades ago in graphite is of the second-order. The jump is preceded by a steady field-induced enhancement of the electronic specific heat. A modest (20 percent) reduction in the amplitude of the magnetic field (from 33 T to 27 T) leads to a threefold decrease of Tc and a drastic widening of the specific heat anomaly, which acquires a tail spreading to two times Tc. We argue that the steady departure from the mean-field BCS behavior is the consequence of an exceptionally large Ginzburg number in this dilute metal, which grows steadily as the field lowers. Our fit of the critical fluctuations indicates that they belong to the 3DXY universality class, similar to the case of He superfluid transition.

Reference :

C. Marcenat et al., Phys. Rev. Lett. 126, 106801 (2021)

First NAME : Bishal	last NAME : Poudel
Affiliation : **Laboratoire Ondes et Matière d'Aquitaine**	

Presentation type : *Short (15 min)*	Talk given in : *English* (please prepare the of the presentation in english)
I authorize the GDR to record a video of my presentation : *YES*	

Photo-emission signatures of coherence breakdown in Kondo alloys

Bishal Poudel[1], Claudine Lacroix[2], Gertrud Zwicknagl[3], Sébastien Burdin[1]

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Kondo alloys are realized in many different families of strongly correlated systems where magnetic impurities are distributed randomly in a metallic crystal and interact with conduction electrons. In these crystals, Kondo impurities are realized by substitution of non-magnetic atoms with magnetic atoms. The disorder and coherence effects of this substitution are still poorly understood in the regime of intermediate concentration x of Kondo atoms. We study these effects with a focus on the photo-emission signatures, including predictions for Angle Resolved Photoemission Spectroscopy (ARPES).

By analyzing the Fermi surface reconstructions, we observe the Lifshitz-like transition predicted previously for strong Kondo coupling T_K when the concentration x equals the electronic filling n_c. At smaller T_K, we found that this transition becomes a crossover, however we identify another transition at a smaller concentration x^* that separates two Kondo paramagnetic phases. The effective mass continuously vanishes at x^*, which is characterized by the merging of a two-branches ARPES dispersion (typical of the coherent dense Kondo phases) into a single branch. This non-standard feature for the dispersion suggests the possibility of realizing “exceptional points” in Kondo alloys.

Références :

[1] Poudel, B., Lacroix, C., Zwicknagl, G., & Burdin, S., arXiv preprint arXiv:2103.03182 (2021).

[2] Poudel, B., Zwicknagl, G., Lacroix, C., & Burdin, S., J. Magn. Magn. Mater., **520**, 167405 (2021).

First NAME : David	last NAME : Santos-Cottin
Affiliation : Université de Fribourg, Suisse	

Presentation type : *Short (15 min)*	Talk given in : *French* (please prepare the of the presentation in english)
I authorize the GDR to record a video of my presentation : *YES*	

Finding Dirac fermions by optical and magneto-optical spectroscopy in the nodal line semimetal $BaNiS_2$

Topological semimetals are a new class of materials that show relativistic-like energy dispersion in three dimensions, and in this way, may be regarded as three-dimensional analogs of graphene [1, 2]. Their band structures present linear band dispersions in the three directions of momentum, and they cross each other at the Dirac or Weyl points [3, 4].
These topological semimetals exhibit huge carrier mobilities and low carrier densities. Moreover, they exhibit a complex and appealing optoelectrical response because their properties are tunable by the magnetic field, temperature, and carrier doping [5–7]. The most interesting physics in such linearly dispersing systems happens at the charge neutrality point, where the two cones merge into an hourglass shape. At this precise point, the carrier mobility spikes, while the carrier density plummets.

I will present you the case of a Dirac nodal-line semimetal, $BaNiS_2$, studied through optical and magneto-optical spectroscopy combined with theoretical calculations. Our results provide direct proof of Dirac fermions' presence linked with characteristic optical and magneto-optical response of linear band dispersions. Often this response is hidden by other contributions – multi band character, intraband transitions, finite linear dispersion range, or band anisotropy. However, thanks to the band structure calculations, we were able to reverse-engineer the optical spectroscopy response to distinguish these different contributions.

Références :

[1] H. Weng et al., Phys. Rev. X **5,** 011029 (2015).
[2] N. M. R. Peres et al., Phys. Rev. B **73**, 125411 (2006).
[3] Z. K. Liu et al., Science **343**, 864 (2014).
[4] M. Neupane et al., Nature Communications **5**, 3786 (2014).
[5] S.-Y. Xu et al., Science **349**, 613 (2015).
[6] Q. Zhou et al., Phys. Rev. B **94**, 121101 (2016).
[7] Y. Zhang et al., Nature Communications **8**, 15512 (2017).

First NAME : Maxence	last NAME : Grandadam
Affiliation : Institut de Physique Théorique, CEA-Saclay	

Presentation type : *Short (15 min)*	Talk given in : *French* (please prepare the of the presentation in english)
I authorize the GDR to record a video of my presentation : Yes	

Fractionalized Pair Density Wave and pseudogap in cuprate superconductors

Cuprate superconductors are one of the most enduring challenges in condensed matter physics. The numerous electronic orders that are observed in the pseudogap phase, before the system becomes a superconductor, makes finding a unifying theory a real challenge. We present here a recent idea [1] where the pseudogap phase is due to the fractionalization of modulated particle-particle pairs, a Pair Density Wave (PDW), into uniform particle-particle pairs, a superconducting (SC) order, and modulated particle-hole pairs, a Charge Density Wave (CDW). Similarly to the electron's fractionalization, the PDW is given by the product of the SC and CDW orders to respect the symmetries. These two new orders are then linked by a constraint which is at the origin of the pseudogap phenomenology.

We develop an effective theory based on the two orders mentioned earlier leading to two phase transitions, the first one being the opening of the pseudogap while the second one is the usual superconducting transition [1]. As soon as we enter the pseudogap phase, amplitudes and phases of the SC and CDW orders are constrained. This phase locking is directly related to some intriguing observations of phase coherence of the CDW order inside superconducting vortices by STM [2]. On the other hand, we show, starting from a microscopic model, that the pseudogap phase presents Fermi arcs as observed by ARPES. We also give a detailed comparison of the energy and temperature dependence of the electronic spectral function with experiments and with numerical DMFT calculations. [3,4,5].

Références :

[1] D. Chakraborty et al., Phys. Rev. B 100, 224511 (2019).

[2] M. H. Hamidian et al., arXiv:1508.00620,

[3] M. Grandadam et al., Phys. Rev. B 102, 121104 (2020)

[4] R.-H. He et al., Science 331, 1579 (2011).

[5] M. Grandadam et al., arXiv:2012.11226