

CMD2020GEFES mini-colloquium

Magnetism and Correlations in 2D Materials in and out of Equilibrium

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The recent discoveries of magnetism, superconductivity and correlated insulating states in 2D materials has spurred gigantic interest in the condensed matter community. Conversely, time-resolved spectroscopies have by now advanced to the point where ultrafast measurements and control of 2D materials properties are within reach. In this mini-colloquium, we will bring together a new generation of scientists bridging the two fields -2D materials and ultrafast phenomena- in order to highlight the fantastic potential that emanates from the combination of both research fields.

We will start with an invited overview talk on prospects of 2D materials, followed by invited talks on the light induced anomalous Hall effect in graphene measured by a cutting-edge ultrafast transport technique; on correlated states in Moiré systems investigated by scanning tunneling spectroscopy and theory; and on time-resolved band structures and dynamical correlations in 2D materials. These longer talks presenting recent research highlights, which have been published in high-profile journals, will be complemented by contributed talks and posters. This mini-colloquium is of interest for scientists working on 2D magnetism and quantum anomalous Hall effects, Floquet-engineered topological phases and non-equilibrium dynamics in atomically-thin materials, as well as correlated insulators and superconductors.

Everyone is aware of 2D magnetism and correlated 2D materials. Not everyone is aware of recent progress in ultrafast dynamics of correlations. The latter harbors such great potential (e.g., ultrafast memory devices, programmable quantum gates for quantum computing) that it would be a waste not to connect these fields and encourage especially PhD students to join the fun.

Monday, 31 August 2020

Zoom host: Jose Luis Fernández Cuñado.

9:30-10:10 *Magnetism in 2D materials: a long history with an attractive future.* **Efrén Navarro-Moratalla (invited).**

10:10-10:50 *Light-induced anomalous Hall effect in graphene.* **James W. McIver (invited), B. Schulte, F.-U. Stein, T. Matsuyama, G. Jotzu, G. Meier and A. Cavalleri.**

10:50-11:10 *Intrinsic 2D-XY ferromagnetism in a van der Waals monolayer.* **Amilcar Bedoya-Pinto, J.-R. Ji, A. Pandeya, P. Gargiani, M. Valvidares, P. Sessi, F. Radu, K. Chang and S. Parkin.**

11:10-11:30 *2D antiferromagnets: exploring inorganic and molecular thin-layers.* **Samuel Mañas-Valero and E. Coronado.**

11:30-11:50 *Exploring the quantum spin liquid 1T-TaS₂ by van der Waals heterostructures.* **Carla Boix-Constant, S. Mañas-Valero, R. Córdoba and E. Coronado.**

11:50-12:10 *Magnetic correlations and time fluctuations in assemblies of Fe₃O₄ nanoparticles.* **Karine Chesnel, J. Rackham, D. McPhearson, B. Newbold, D. Griner, D. Smith, M. Transtrum, R. Harrison, A. Reid and J. Kortright.**

12:10-12:30 *Attosecond transient absorption in graphene.* **Antonio Picón.**

Tuesday, 01 September 2020

Zoom host: Jose Luis Fernández Cuñado.

9:30-10:10 *Non-equilibrium quantum matter on demand.* **Dante Kennes (invited).**

10:10-10:50 *Ultrafast Light-Induced Lifshitz Transition.* **Ralph Ernstorfer (invited).**

10:50-11:10 *Nonthermal interacting-magnon dynamics in an optically driven 2D Heisenberg antiferromagnet.* **Mona Kalthoff, D. Kennes, A. Millis, M. Sentef.**

11:10-11:30 *Collective modes in pumped unconventional superconductors with competing ground states.* **Marvin Müller, P. A. Volkov, I. Paul and I. M. Eremin.**

11:30-11:50 *Spectroscopic evidence for tuneable electron-magnon coupling in the surface ferromagnetic layer of Pd-terminated PdCoO₂.* **Federico Mazzola, V. Sunko, S. Khim, H. Rosner, P. Kushwaha, O. J. Clark, L. Bawden, I. Marković, T. K. Kim, M. Hoesch, A. P. MacKenzie and P. D. C. King.**

11:50-12:10 *2D Materials in Strong Magnetic Fields: Hofstadter physics from first-principles.* **Vasil Rokaj, M. Penz, M. Sentef, M. Ruggenthaler and A. Rubio.**

12:10-12:30 *Crescent states in charge-imbalanced polariton condensates.* **Artem Strashko, F. M. Marchetti, A. H. MacDonald, and J. M. J. Keeling.**

Special sessions Tuesday Afternoon

Zoom host: Jose Luis Fernández Cuñado. [Pre-recorded talks and poster videos on YouTube.](#)

Pre-recorded talks

1. Chromium triiodide: The multiple magnetic phase ferromagnet. **Jaume Meseguer-Sánchez, D. A. Wahab, E. Navarro-Moratalla, G. Zurab and E. J. G. Santos.**



2. *Charge density wave in monolayer 1T-TiTe₂*. **Tommaso Antonelli**, W. Rahim, M. D. Watson, A. Rajan, D. O. Scanlon and P.D.C. King.
3. *Extremely imbalanced two-dimensional electron-hole-photon systems*. **Antonio Tiene**, J. Levinsen, M. M. Parish, A. H. MacDonald, J. Keeling and F. M. Marchetti.
4. *Excitons in 2D Topological Insulators: Study of Bi(111) bilayers*. **Alejandro José Uría Álvarez** and J. J. Palacios.
5. *Magnetic anisotropy and spin dynamics in the kagome magnet Fe₄Si₂Sn₇O₁₆: An NMR and magnetic-susceptibility study on oriented powder*. **Shanu Dengre**, R. Sarkar, L. Opherden, T. Herrmannsdörfer, T. Söhnle, M. Allison, C. D. Ling, J. S. Gardner and H.-H. Klaus.
6. *Theory of Photon Condensation in a Spatially-Varying Electromagnetic Field*. **Francesco Pellegrino**, G.M. Andolina, V. Giovannetti, A.H. MacDonald and M. Polini.

Posters

1. *Effect of the cations distribution on the magnetic properties of SnFe₂O₄: First-principles study*. **Mohamed Tadout**, R. Lamouri, M. Hamedoun, A. Benyoussef, H. Ez-zahraouy, M. Benaissa, O. Mounkachi.
2. *Modeling magnetic correlations in magnetite nanoparticle assemblies using x-ray magnetic scattering data*. **Johnathon Rackham**, B. Newbold, S. Kotter, D. Smith, D. Griner, R. Harrison, A. H. Reid, M. Transtrum and K. Chesnel.
3. *The Analysis of Magnetite Nanoparticles Allowed to Warm through Superparamagnetic Transition*. **Daniel McPherson** and K. Chesnel.
4. *First Principle Investigation of Magnetic Properties for Ni/Co adsorbed Sb/h-BN van-der Waals heterostructure*. **Anup Shrivastava**, S. Saini and S. Sing.