

Colloquium IPCMS - CESQ

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IPCMS Auditorium

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Electrical doping and strong light-matter coupling

In this talk I will discuss three examples illustrating the interplay between electrical doping and strong light-matter coupling. First, I will consider doped inorganic polariton condensates, where the competition between Coulomb interactions, population imbalance, and the extremely light polariton mass leads to a rich phase diagram that includes unconventional paired states and the emergence of a "crescent" phase that simultaneously exhibits pairing and a metallic Fermi surface [1]. Second, I will discuss Fermi polarons in doped transition-metal dichalcogenides, showing how the nature of polaron formation depends on whether the excess carriers are distinguishable from, or identical to, those forming the exciton, leading to qualitatively different optical signatures and many-body states [2]. Finally, I will turn to organic polaritons, where strong coupling can influence charge transport by modifying the vibrational structure of molecular excitations. Using a microscopic model, I will show how polariton formation can enhance or suppress charge-hopping processes through the mechanism of polaron decoupling [3].

Together, these examples highlight the diverse ways in which electrical doping and strong light-matter coupling can cooperate to generate novel effects, providing new opportunities to manipulate both optical and electronic properties.

References

- [1] A. Strashko, F. M. Marchetti, A. H. MacDonald, and J. Keeling. Phys. Rev. Lett. 125 067405 (2020)
- [2] A. Tiene, J. Levinsen, M. M. Parish, A. H. MacDonald, J. Keeling, and F. M. Marchetti. Phys. Rev. Res. 2 023089 (2020)
- [3] M. A. Zeb, P. G. Kirton, and J. Keeling. Phys. Rev. B 106 195109 (2022)