COLLÈGE DE FRANCE 1530

Jeunes Equipes de l'Institut de Physique du Collège de France

Cavity Quantum Electrodynamics, Nanophotonics, Correlated electrons

Recently, there has been a blooming interest in modifying electronic structures through the influence of cavity vacuum fluctuations[1,2]. While Fabry-Perot cavities have demonstrated moderate impact on matter due to their relatively weak coupling strength, a promising avenue lies in the use of deep-subwavelength cavities, which confine the electromagnetic field within a small volume below the diffraction limit. One largely unexplored example are hyperbolic phonon-polaritons cavity, constructed from layered hexagonal boron-nitride. These materials combine tightly confined electromagnetic fields, a good quality factor, and also display exotic "hyperbolic" characteristics.

The primary objective of this project is to delve into the quantum fluctuations within these hyperbolic cavities and explore their interactions with various quantum phases[3]. During this theoretical internship, the Master's student will acquire, develop, and apply state-of-the-art techniques in quantum many-body physics and cavity Quantum Electrodynamics (QED). This will enable the student to investigate the emergent phases of matter within cavity-embedded systems.

[1] O Dmytruk, M Schiró, Physical Review B 103 (7), 075131 (2021)

[2]GM Andolina, FMD Pellegrino, V Giovannetti, AH MacDonald, M Polini, Physical Review B 100 (12), 121109 (2019)

[3]Z Bacciconi, GM Andolina, T Chanda, G Chiriacò, M Schirò, M Dalmonte SciPost Physics 15 (3), 113 (2023)

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