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Streszczenie pracy pt. "Tight-binding framework to study optical properties of graphene nanoantennas with adatoms" - wersja angielska

The thesis introduces tools to describe dynamics in hybrid systems consisting of a graphene nanoflake and a coupled two-level system subject to external illumination. The presented formalism combines perspectives from different areas of physics, in particular solid state theory, optics and plasmonics. Graphene nanoflakes with the adatom are described using the tight-binding approximation in a single-particle formalism. As a consequence, the presented method is computationally efficient and allows to simulate relatively large systems consisting of hundreds of atoms. The time evolution is described with the master equation, including dissipation in two various forms. The thesis also contains an analysis of processes occuring in the two-level system - Rabi oscillations and spontaneous emission - and their modification in the presence of a graphene nanoflake. An important part of the thesis are predictions about the evolution of the above-mentioned hybrid systems, which were obtained by a numerical implementation of the introduced framework in Python. The presented results involve graphs of energy levels of the system, the real-space charge distribution of eigenstates, absorption spectra, symmetry breaking due to the adatom presence, change of Rabi oscillations caused by the adatom coupling, spontaneous emission in the adatom and its dependence on the flake-adatom distance.

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