WWU MÜNSTER

Aktuelle Fragen
der Nanophysik

Dienstag, 22.11.2022 um 15:15 Uhr
HS 2, Wilhelm-Klemm-Str. 10

GHz acoustic control of flying and single excitons in quantum nanostructures


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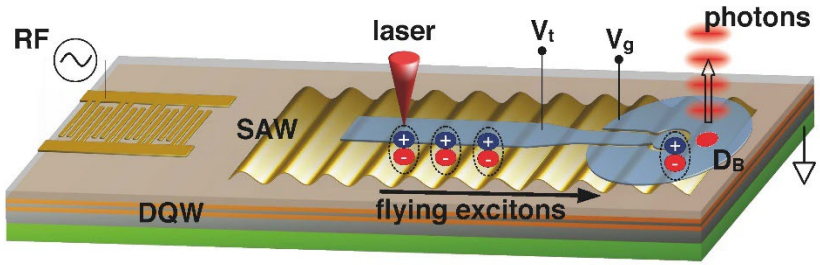
An important prerequisite for quantum communication networks is the transfer and manipulation of single particles on a chip, as well as their interconversion to single photons for the long-range information exchange. GHz acoustic waves are versatile tools for the implementation of these functionalities in hybrid quantum systems. In particular, flying excitons propelled by GHz surface acoustic waves (SAWs) can potentially satisfy the aforementioned prerequisite.

In this talk, I will present our recent work on the manipulation of excitons in GaAs quantum well structures using acoustic waves in the GHz regime. We launch the surface acoustic wave (SAW) to create flying excitons in semiconductor quantum wells. Furthermore, we have identified suitable two level centers to store single excitons, acting as single excitonic qubits, and interconvert them to single photons with a very high emission rate dictated by the SAW. This work paves the way for on-chip exciton-based qubit manipulation.



SAW: surface acoustic wave
DQW: double quantum well
D_B: single center