**Indirect Excitons transport in confined acoustic potentials**

**- Towards an integrated optical multiplexer**

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A spatially indirect exciton (IX) is a bound state of an electron and a hole localized in different quantum wells of a double quantum well structure (DQW, cf. Fig. 1). IX are formed by applying an electric field across the DQWs increases the IX lifetime while still maintaining the Coulomb interaction between them. Due to their long lifetimes and strong non-linear properties arising from dipole-dipole interactions [1, 2] IXs are particularly interesting for applications in optoelectronic devices.

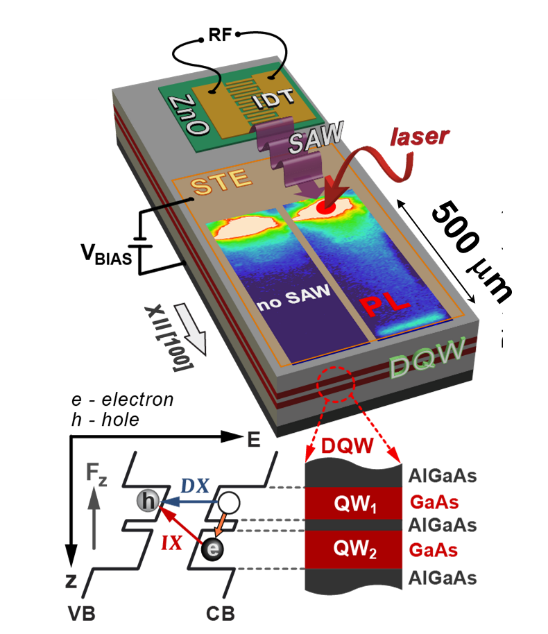
In this contribution, we demonstrate that a high degree of control of IX fluids can be obtained by combining their electrostatic manipulation via electrostatic gates with the long - range IX transport achieved by Surface Acoustic Waves (SAW). The experiments were carried out in (Al,Ga)As DQW samples grown by molecular beam epitaxy. SAWs propagating along a non-piezoelectric <100> surface direction were electrically generated using interdigital transducers deposited on a piezoelectric ZnO-island. The IX dynamics during acoustic transport was investigated using spatially and spectrally resolved photoluminescence (PL). The moving type-I band-gap modulation induced by the SAW strain field traps and transports IXs [3] over distances up to one mm. Moreover, we demonstrate that IXs can be transferred between orthogonal SAW beams, thus opening the way for the control of the transport direction of exciton fluids. The transfer is mediated by a moving array of potential dots created by the interference of two orthogonal SAW beams, which captures the IXs from the incoming beam and transfers them to the other. The mechanisms for the acoustic transport as well as for the IX transfer between beams have been investigated by PL and supported by numerical simulations based on a theoretical model for hydrodynamics of interacting dipolar excitons. These functionalities are combined to realize an IX acoustic multiplexer (EXAM), a device which controls IX flow between different input and output ports. The EXAM is a proof-of-concept for all exciton optoelectronic device but also offers a controllable way for artificially producing cold IX gases confined in zero-dimensional moving strain dots. It, therefore, provides a promising platform to investigate the dipole-dipole interactions as well as collective phenomena of IXs.

Figure 1 Transport of indirect excitons (IXs) in a double quantum well (DQW) structure by a SAW generated by an interdigital transducer (IDT) detected by photoluminescence (PL). The lower panel shows the layer structure of the sample.

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[2] M. Baldo and V Stojanovi, Nature Photon. 3, 558-560 (2009).

[3] J. Rudolph, R. Hey and P. V Santos, Phys. Rev. Lett. 99, 047602 (2007)

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