Rydberg excitons in Cu_2O-based superlattices

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The so-called structured excitons [1] can be used as a means of transporting information and energy in quantum information processing. From this point of view, controlling these excitons in a superlattice [2] can be a very interesting problem. Such a system causes a large shift of exciton energy states and thus influences optical and electronic properties. In principle, a superlattice (SL) containing a Rydberg exciton is a solid-state analog of a Rydberg atom trapped in an optical lattice and can be a promising tool in quantum computing [3–5]. A superlattice can also be used as a medium for exciton-exciton interaction experiments [1].

We consider a superlattice with a the total thickness of the order of 100 nm and individual layer thickness of the order of a few nm and describe the optical properties of this SL: the optically active layers of cuprous oxide and buffer layer of magnesium oxide MgO create a system of quantum wells, characterized by a periodic potential.

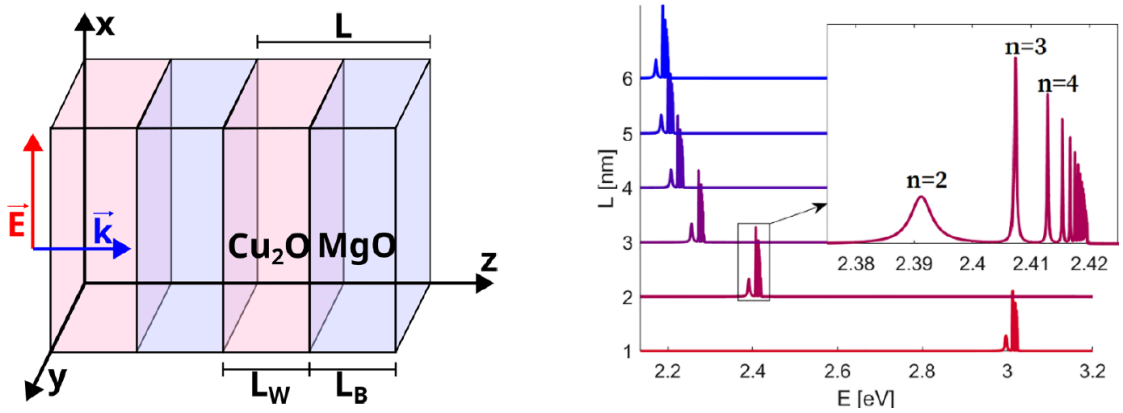

Fig. 1. a) Schematic representation of the system b) energy shift of Rydberg states as a function of SL period.

References

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