RydEx 2024, Dortmund, Germany

Hyper-Raman effect on magnetic-field-coupled 1S excitons in Cu_2O

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We analyzed the polarization dependence of the hyper-Raman effect for magnetic field-coupled 1S exciton polaritons in cuprous oxide (Cu_2O), a material recently recognized for hosting Rydberg excitons with high principal quantum numbers [1]. The hyper-Raman effect is a coherent process consisting of a two-photon excitation on the polariton branch and an emission of both a phonon and a photon. Characteristic polarization selection rules for this process are derived through group theoretical considerations. Applying this approach, the full polarization dependence of this process was simulated and measured for the hyper-Raman effect at a magnetic field of 10 T in Voigt configuration. Power dependence in the range of 1 to 100 mW was measured for all phonon modes. The intensity of the hyper-Raman signal exhibits an almost quadratic increase with excitation power. Saturation occurs at higher power levels due to the saturation of the exciton population. Temperature dependence was measured in the range from 1.2 to 60 K. It is showing not monotonical behavior. It appears that anharmonic effects are involved in the process.

References

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