Time-resolved second harmonic generation on Cu2O Rydberg excitons

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For the last decade, highly excited (Rydberg) states of electron-hole bound states (excitons) in the semiconductor Cu2O have been showing more and more similarities with their atomic relatives, enabling solid-state Rydberg physics. This talk will describe recent experimental results where the resonant second harmonic generation (SHG) process [2] is time-resolved with sub-picosecond resolution.

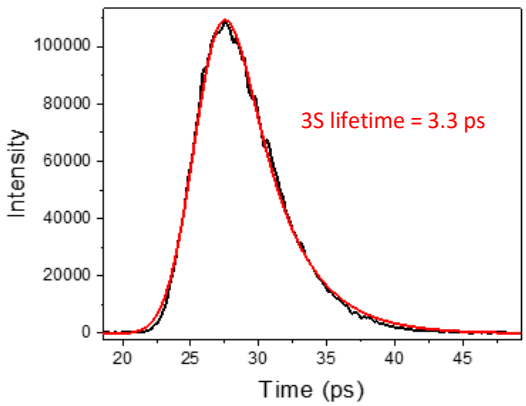

Fig. 1. Example of time-resolved SHG signal, here resonant for the 3S exciton state in Cu2O.

This technique not only enables the direct measurement of the Rydberg states lifetimes but also reveals several intriguing dynamics, including the existence of two different mechanisms for SHG, an accelerated decay for large exciton density and traces of coherence lasting up to the state lifetime. Directly measuring the lifetime also enables to check for inhomogeneous broadening in the current high-precision spectroscopic data [3].

References

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