



PHOTONICS LECTURE

THURSDAY, 4 JULY 2024 | 12.10

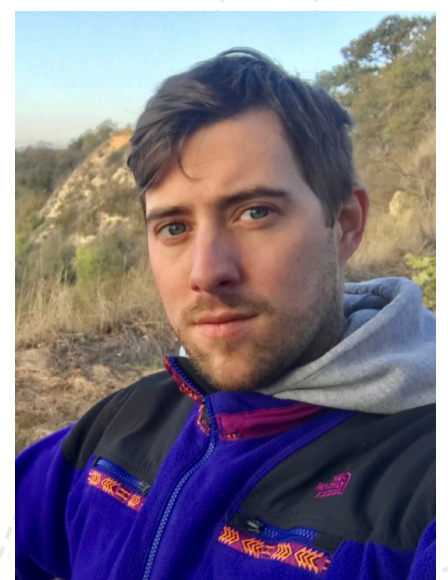
JUN.-PROF. DR. THOMAS BOULIER

TU DORTMUND, VIA ZOOM

Time-resolved second harmonic generation on Cu₂O Rydberg excitons

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

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], which participates in charting the possibilities offered by Cu₂O for future solid-state Rydberg technologies."



Jun.-Prof. Dr. Thomas Boulier,
TU Dortmund

References

- [1] Kazimierczuk, T., Fröhlich, D., Scheel, S., Stolz, H. and Bayer, M., 2014. Giant Rydberg excitons in the copper oxide Cu₂O. *Nature*, 514(7522), pp.343-347.
- [2] Mund, J., Fröhlich, D., Yakovlev, D. R., & Bayer, M. (2018). High-resolution second harmonic generation spectroscopy with femtosecond laser pulses on excitons in Cu₂O. *Physical Review B*, 98(8), 085203.
- [3] Rogers, J.P., Gallagher, L.A., Pizzey, D., Pritchett, J.D., Adams, C.S., Jones, M.P., Hodges, C., Langbein, W. and Lynch, S.A., 2022. High-resolution nanosecond spectroscopy of even-parity Rydberg excitons in Cu₂O. *Physical Review B*, 105(11), p.115206.