



# SFB1242

Nichtgleichgewichtsdynamik kondensierter  
Materie in der Zeitdomäne

UNIVERSITÄT  
DUISBURG  
ESSEN

Open-Minded

12.05.2026 / 10 Uhr c.t., Raum MG 272  
Campus Duisburg

## Dynamical Projective Operatorial Approach: An Efficient Framework for Ultrafast Out-of-Equilibrium Dynamics

Dr. Amir Eskandari-asl

Università degli Studi di Salerno

This talk introduces the Dynamical Projective Operatorial Approach (DPOA), a theoretical framework designed for the efficient simulation and analysis of out-of-equilibrium systems, specifically in the ultrafast regime. After establishing the core formalism, I demonstrate its versatility across several applications, including: resolving excitation mechanisms in semiconductors and altermagnets, simulating TR-ARPES signals, and modeling transient optical properties such as reflectivity, absorption, and the Kerr rotation. Finally, I will share recent results from ongoing research regarding pumped excitonic systems and the emerging physics of altermagnets.

- [1] G. Inzani, L. Adamska, A. Eskandari-asl et al. "Field-driven attosecond charge dynamics in germanium." *Nature Photonics* **17.12**: 1059-1065 (2023).
- [2] G. Inzani, A. Eskandari-asl et al. "Attosecond tuning of coherent electron dynamics in doped semiconductors." Accepted for publication in *Nature Photonics* (2026).
- [3] A. Eskandari-asl, J. I. Facio, O. Janson, A. Avella, and J. van den Brink. "Controlling photoexcited electron spin by light polarization in ultrafast-pumped altermagnets." *Physical Review B* **112.2**: 024401 (2025).
- [4] A. Eskandari-asl, A. Avella. "Time-resolved ARPES signal in pumped semiconductors within the dynamical projective operatorial approach." *Physical Review B* **110.9**: 094309 (2024).
- [5] A. Eskandari-asl, A. Avella. "Generalized linear response theory for pumped systems and its application to transient optical properties." *Physical Review A* **110.4**: 043520 (2024).
- [6] A. Eskandari-asl, A. Avella. "Magneto-optical Kerr effect in pump-probe setups." *Physical Review A* **113.1**: 013738 (2026).
- [7] A. Eskandari-asl, A. Avella. "Controlling Ultrafast Excitations in Germanium: The Role of Pump-Pulse Parameters and Multi-Photon Resonances." *Materials* **19.2**: 408 (2026).
- [8] A. Eskandari-asl, A. Avella. "Dynamical Projective Operatorial Approach (DPOA): Theory and Applications to Pump-Probe Setups and Semiconductors." *Materials* **18.6**: 1310 (2025).

Für diese Zeit steht eine Kinderbetreuung nach vorheriger Anmeldung zur Verfügung.

Contact: Prof. Dr. Björn Sothmann, Faculty of Physics  
Phone: +49 (203) 37-93330 / Mail: bjoerns@thp.uni-due.de