

Seeing Atoms and Electrons in Space and Time with Attosecond Electron Microscopy

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K. H. Eberle-Stiftung

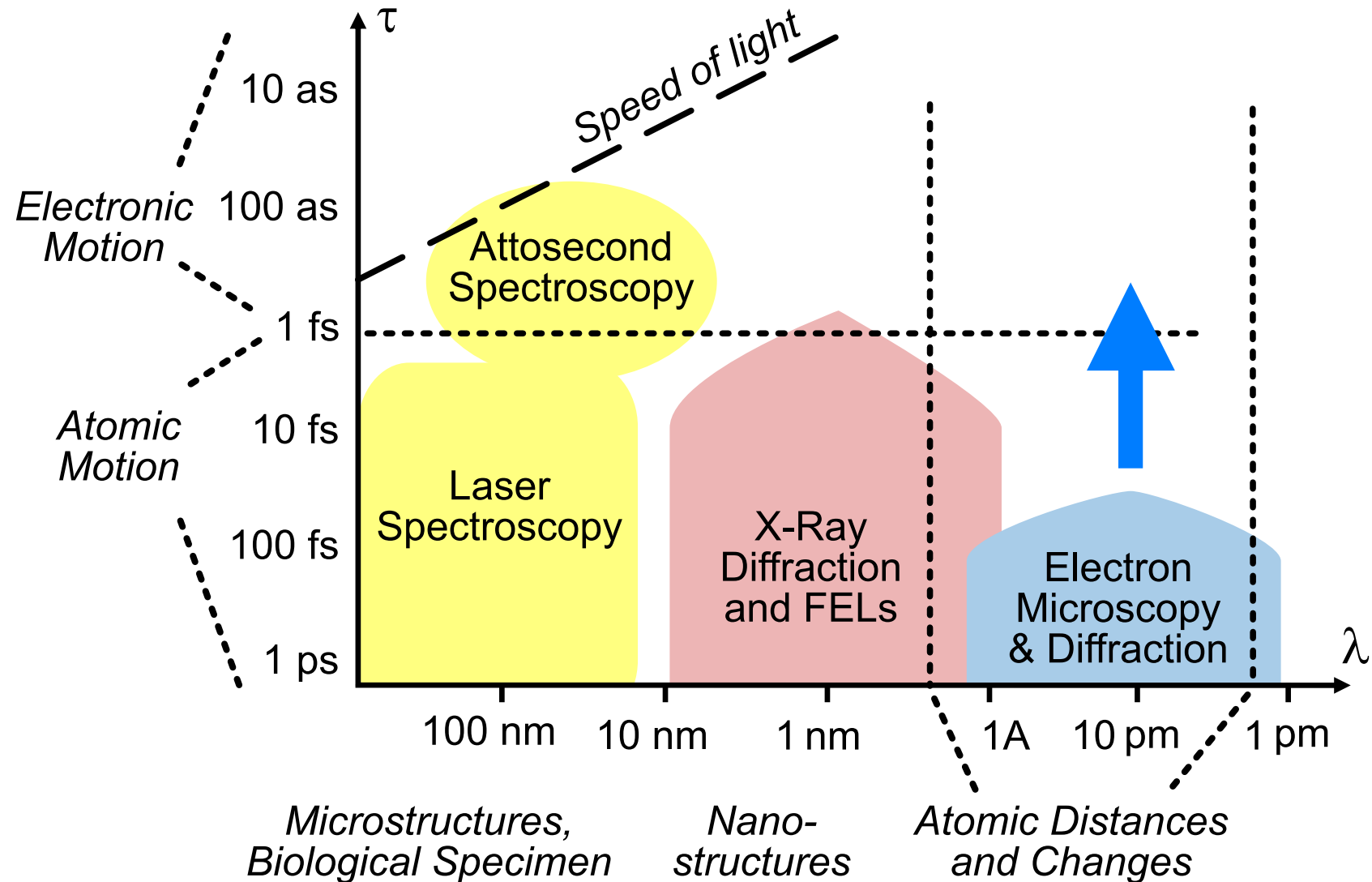
Vector Stiftung

MAP Centre Munich

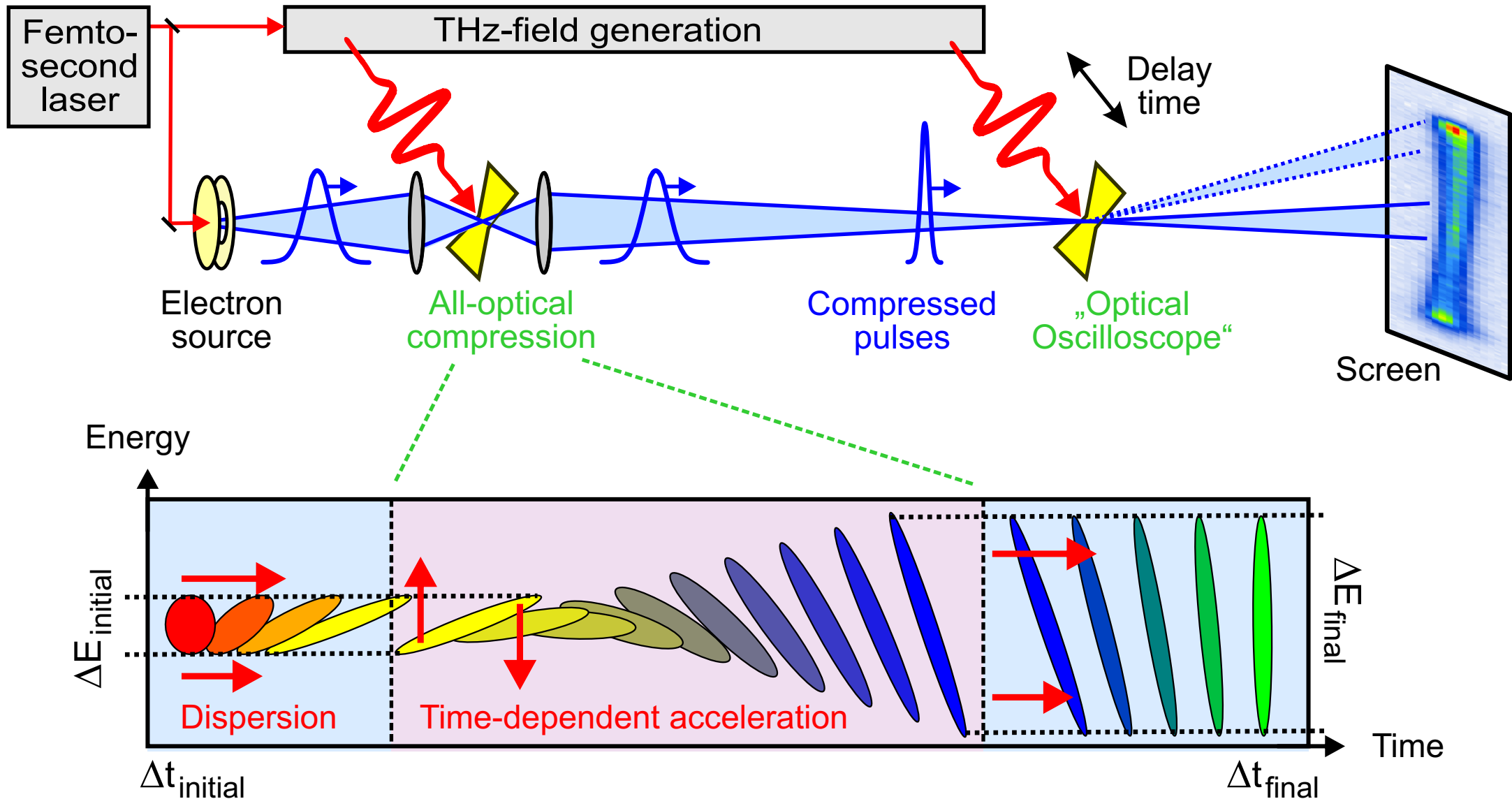
Rudolf-Kaiser-Stiftung

European Research Council

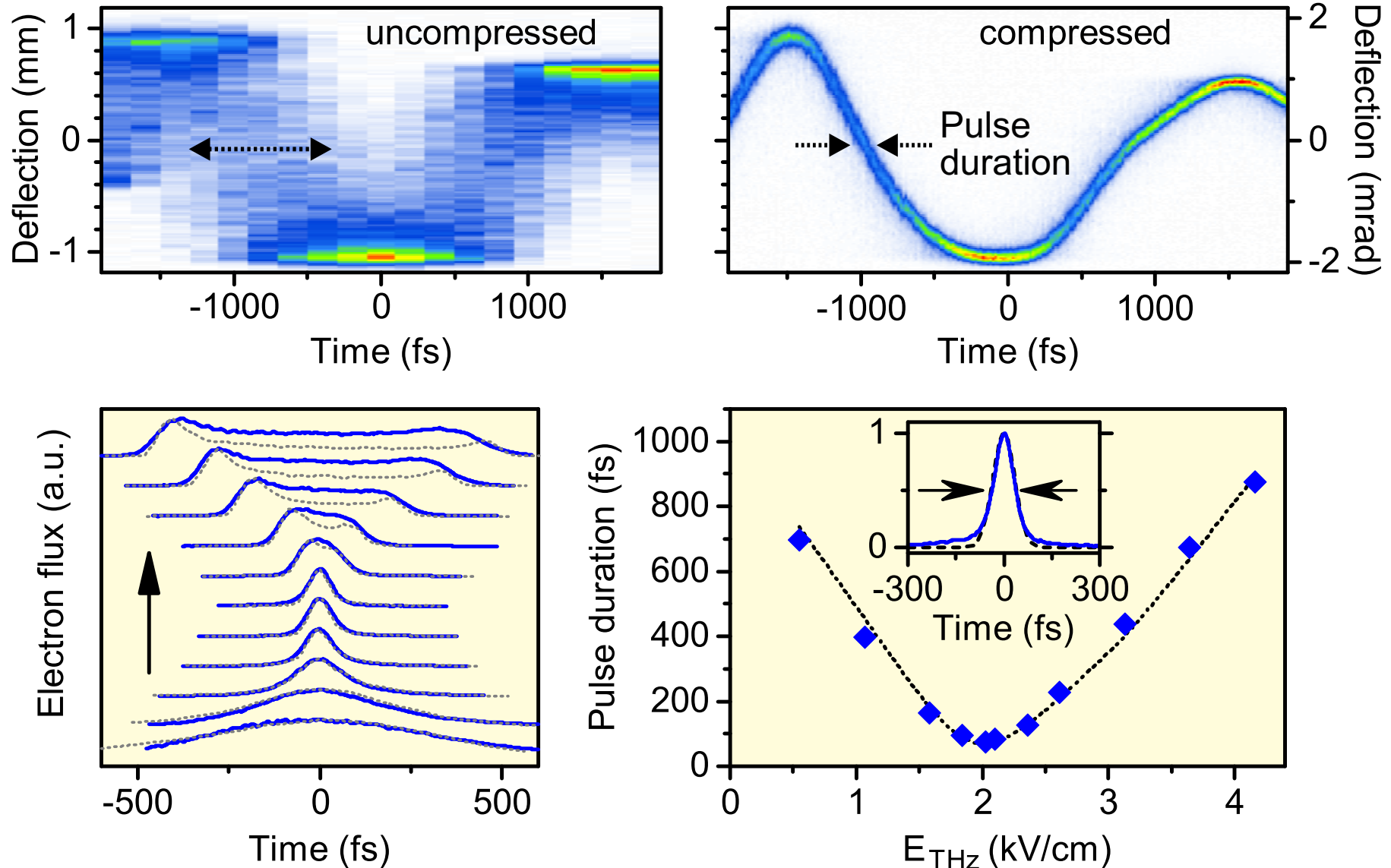
Approaches for Imaging in Space and Time



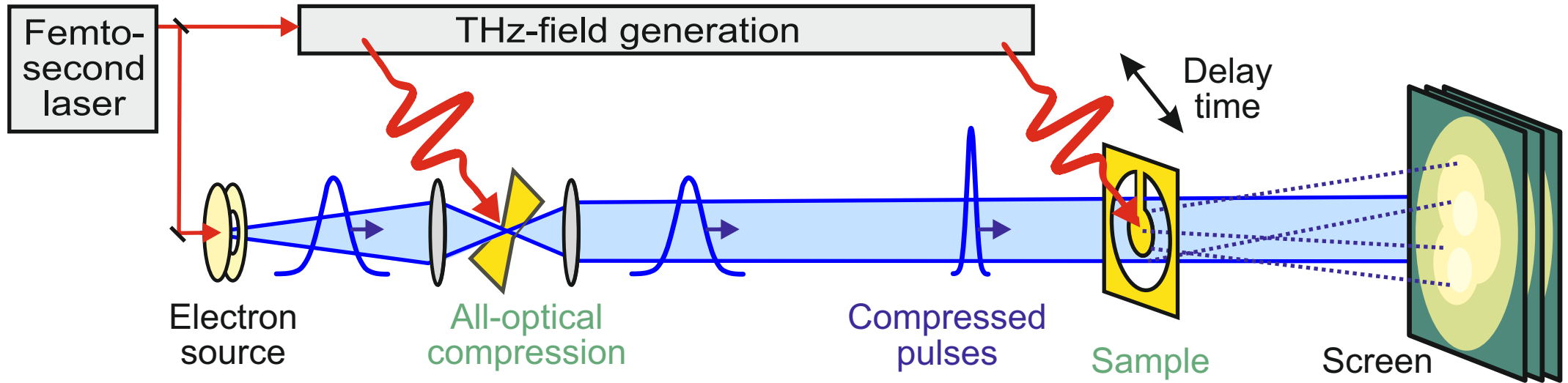
Electron pulse compression using THz fields



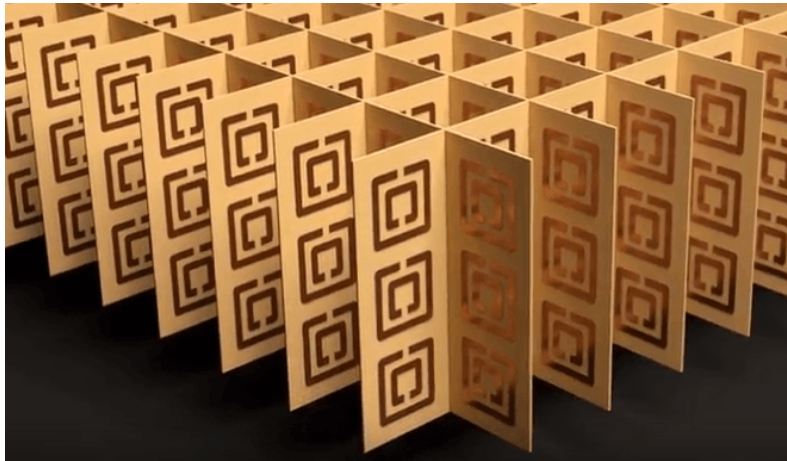
All-optical electron pulse compression



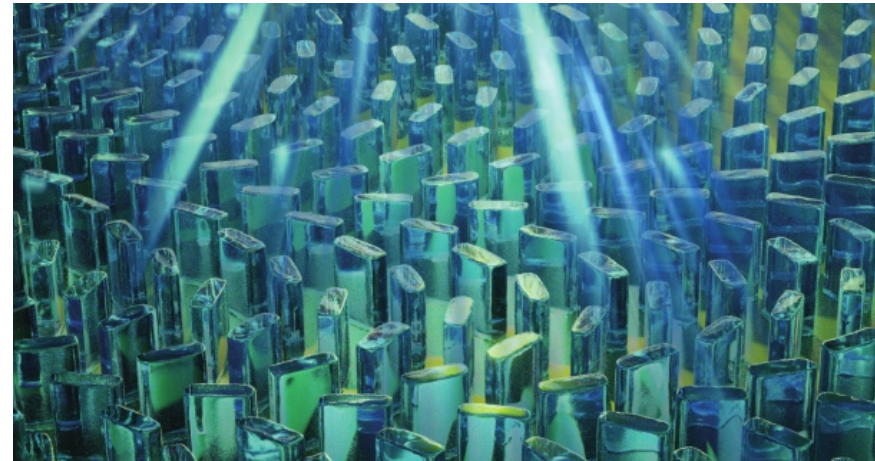
Electron Microscopy of Electromagnetic Waveforms



Metamaterials



Kildishev, Boltasseva, Shalaev, Science 339 (2013).

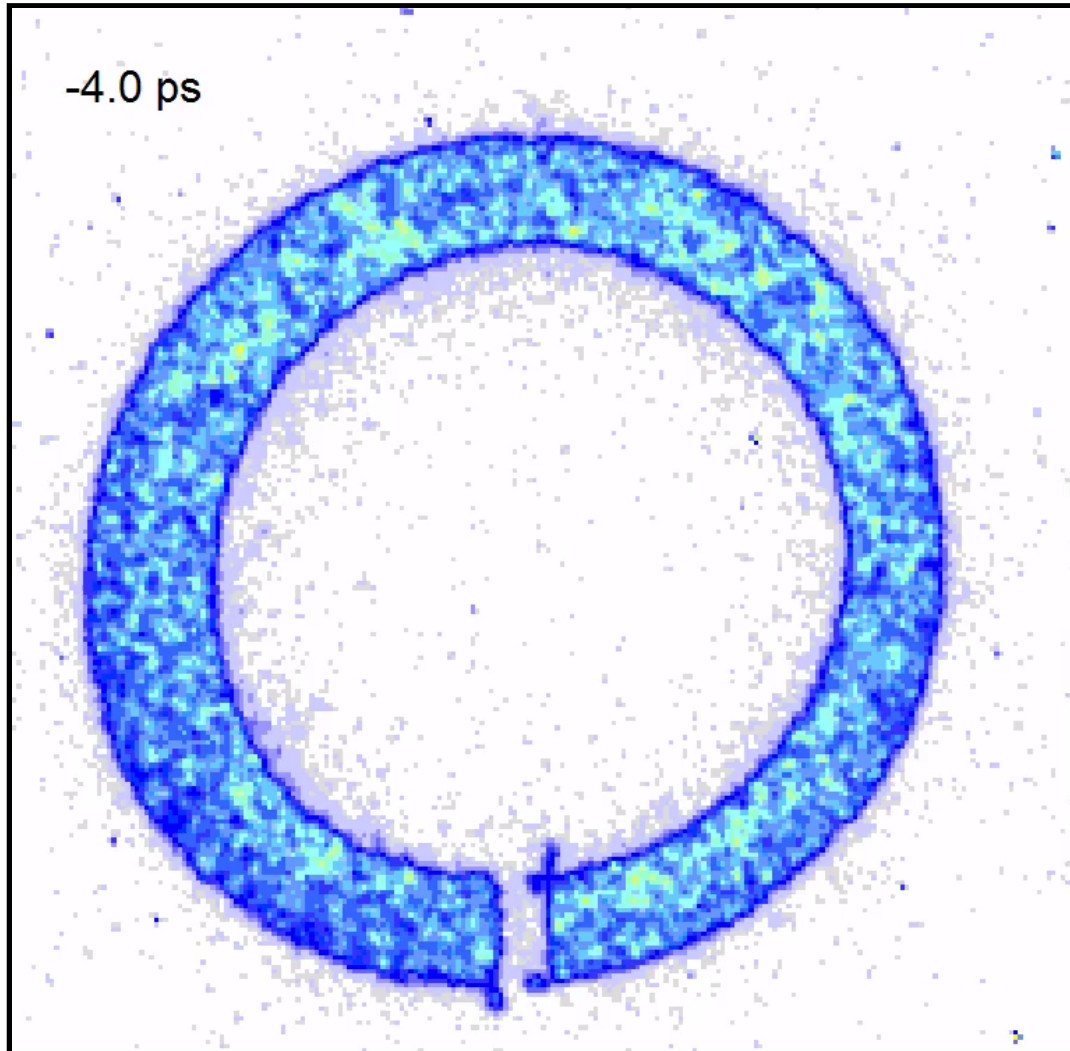


Khorasaninejad, Capasso, Science 358 (2017).

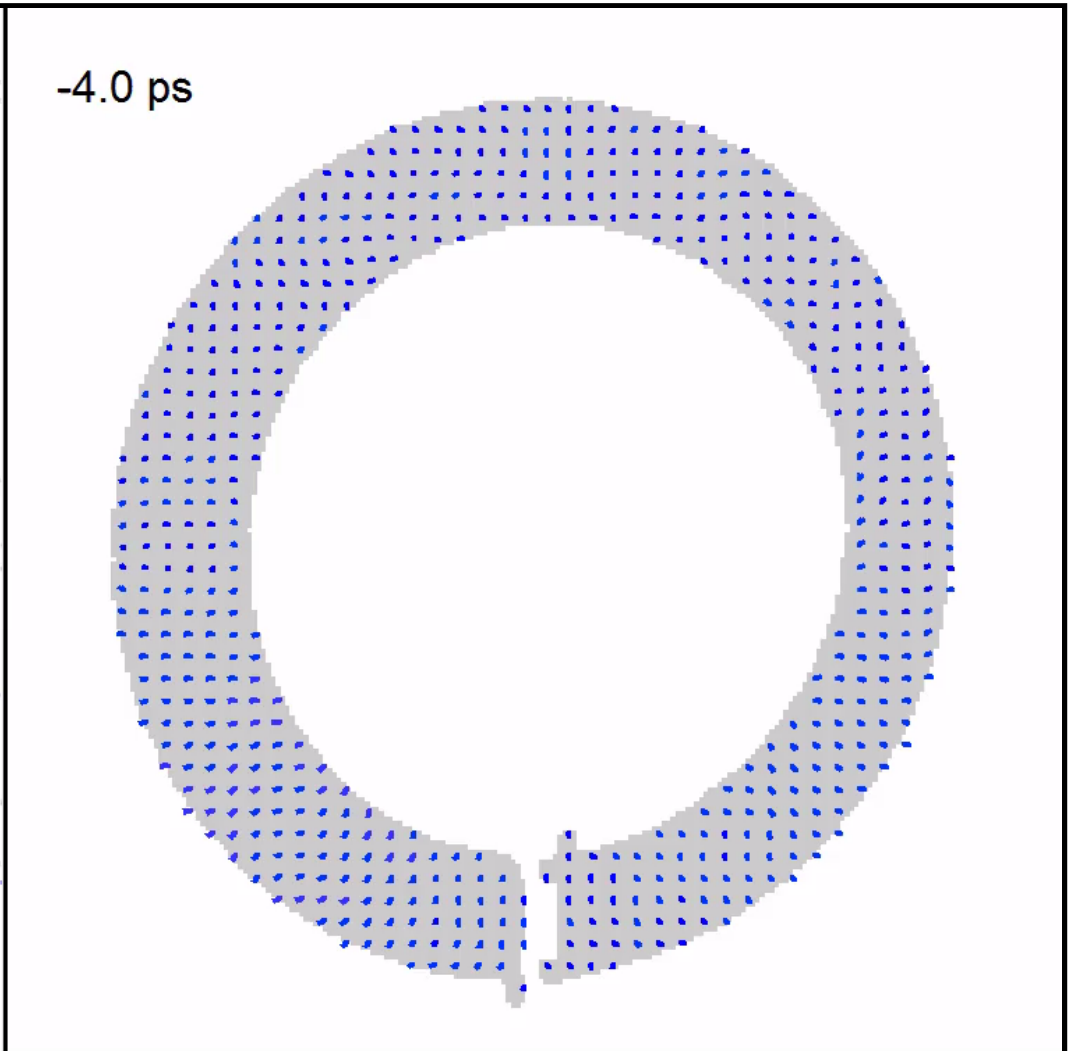
A. Ryabov and P. Baum, Science 353, 374 (2016).

Electron Microscopy of Electromagnetic Waveforms

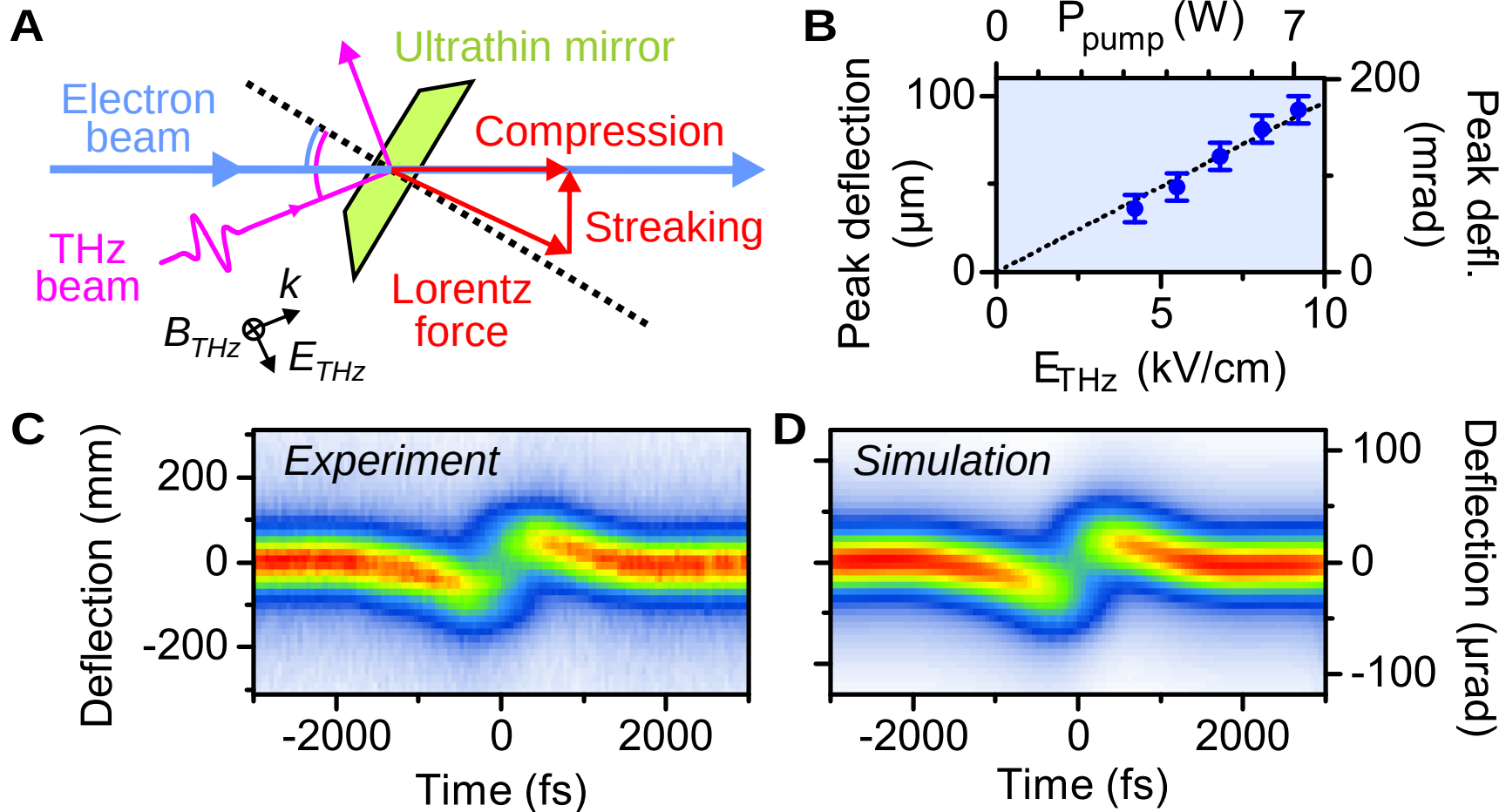
Raw data on screen



Electric field in space and time



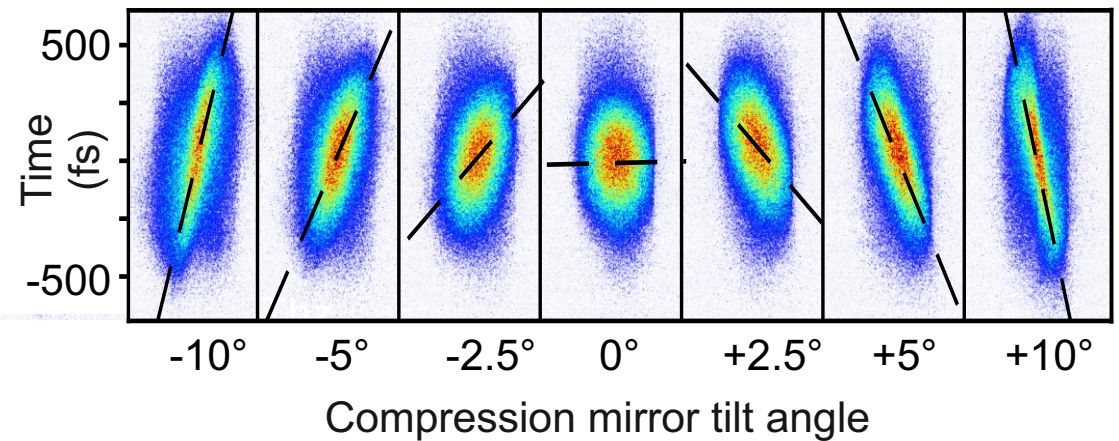
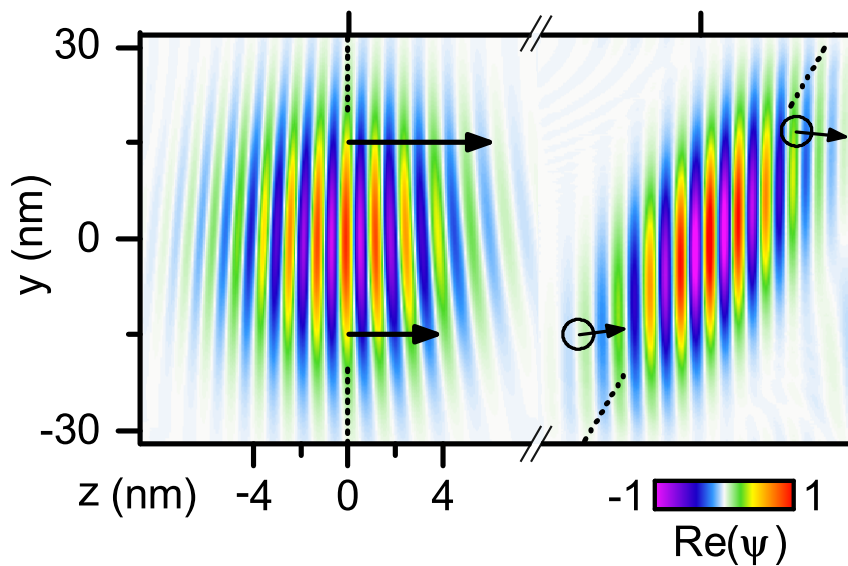
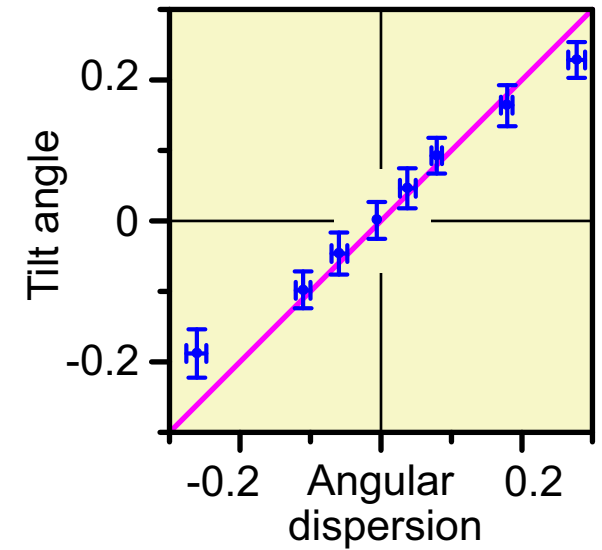
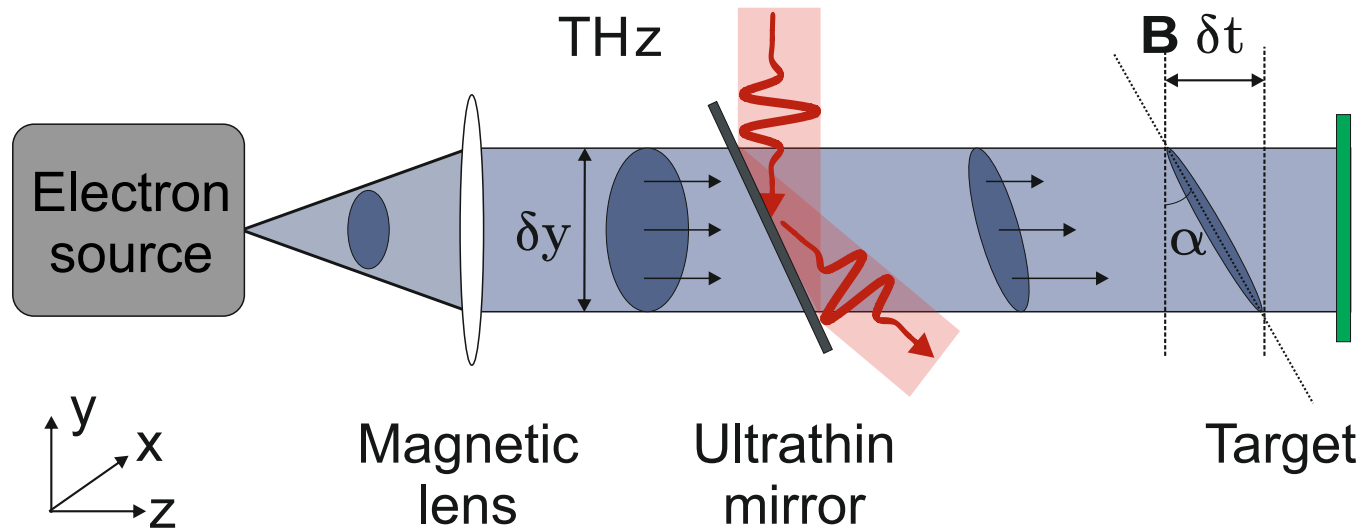
Electron pulses in a single optical cycle



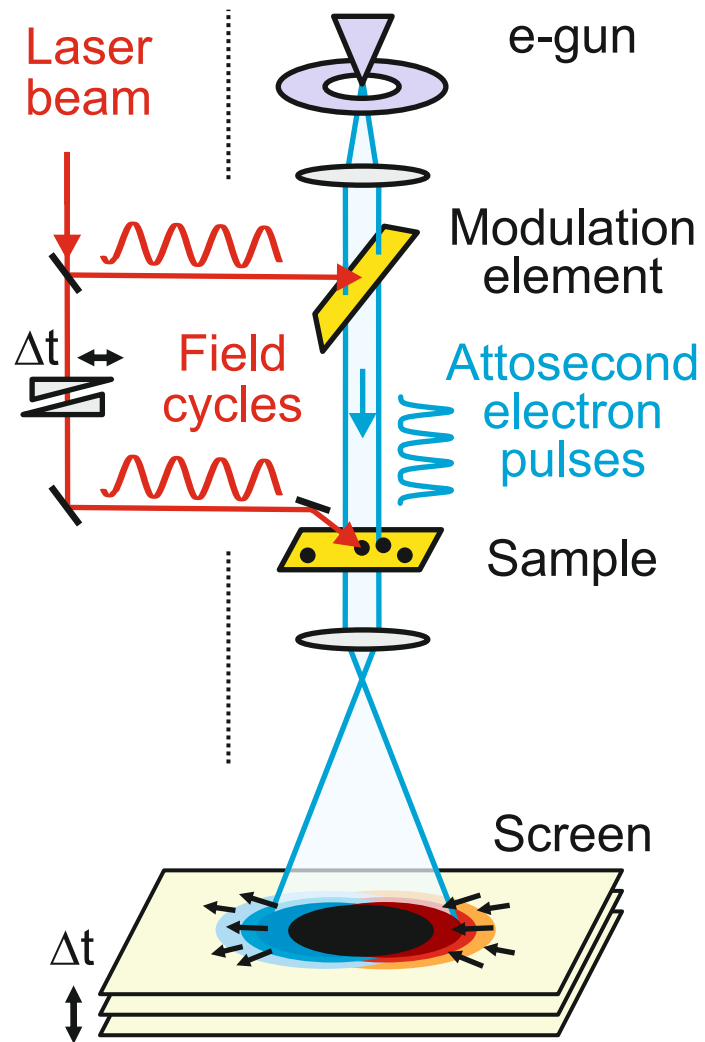
F. O. Kirchner, A. Gliserin, F. Krausz, P. Baum, Nat. Photon. 8, 52 (2014).

C. Kealhofer, W. Schneider, D. Ehberger, A. Ryabov, F. Krausz, P. Baum, Science 352, 429 (2016).

Tilted electron pulses

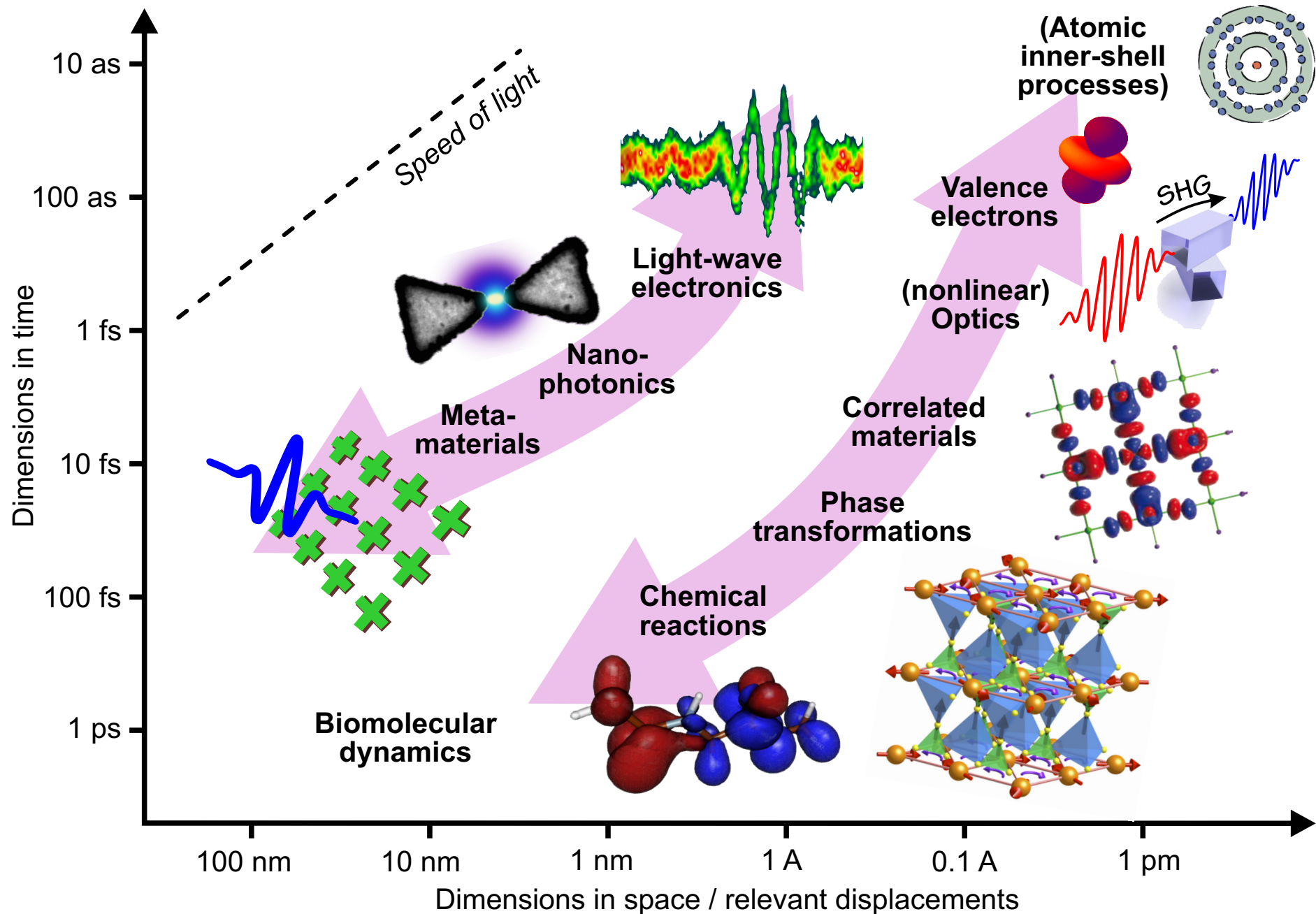


Towards Light-Cycle Contrast in Electron Microscopy



A. Ryabov, J. Thurner, D. Nabben, M. Tsarev, P. Baum, in review (2020).

Light-driven Electronic and Atomic Motion



Summary and Conclusions

Single-electron
Pulses under
Light-cycle Control

Atomic/Electronic
Space-Time
Imaging

Understanding
Complex
Materials

Significance and Perspective

