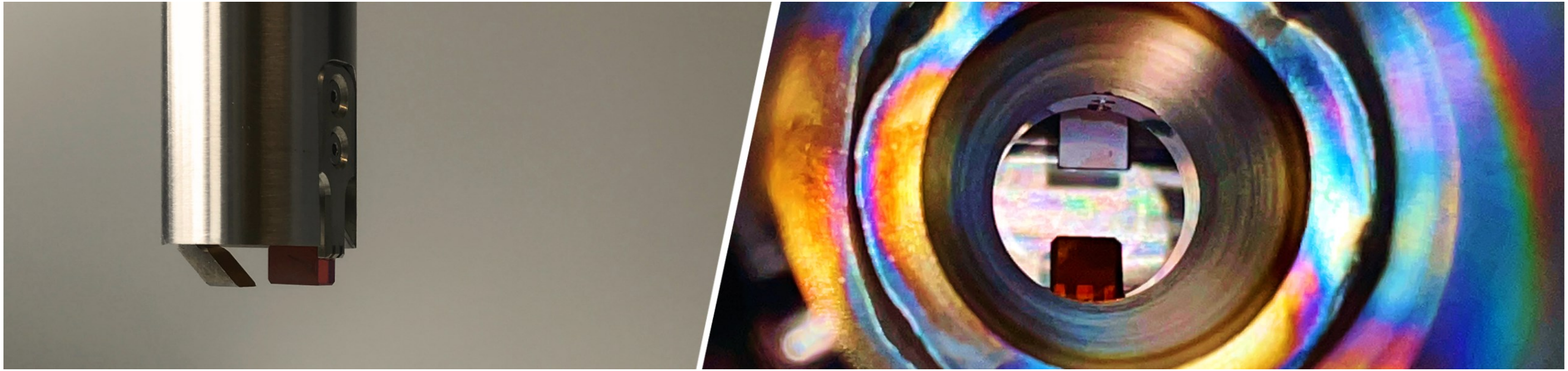
Karlsruhe Institute of Technology

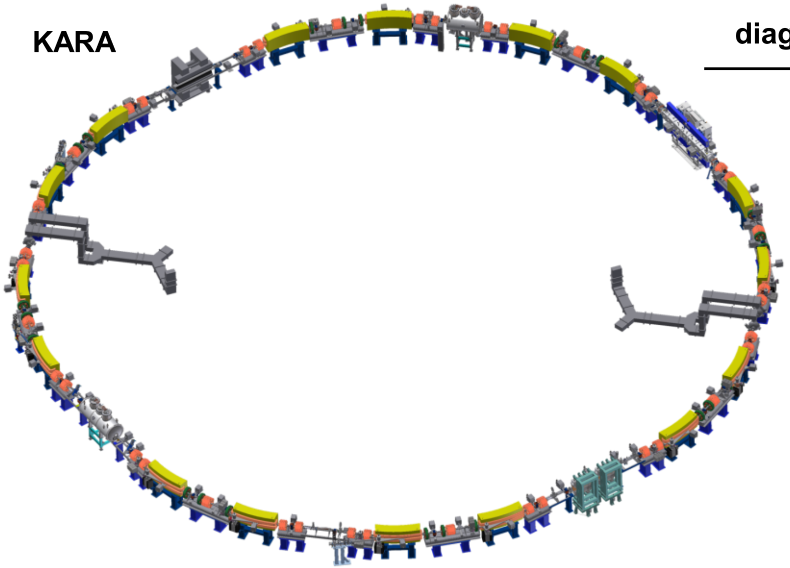
Spatial and Phase Space THz-Tomography at the Karlsruhe Research Accelerator (KARA)

S. Funkner, A. Santamaria Garcia, E. Bründermann

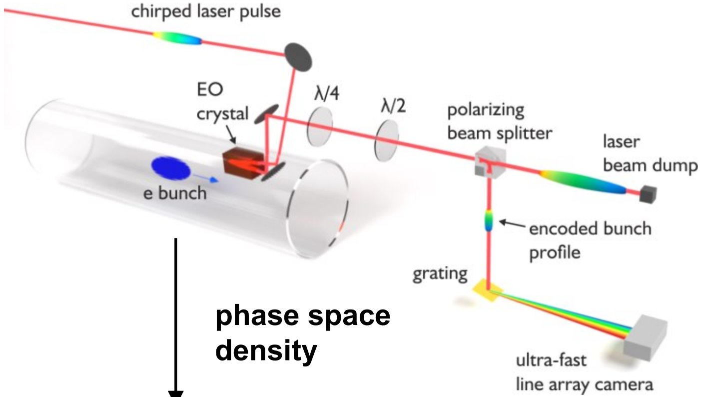


Phase Space Tomography

KARA

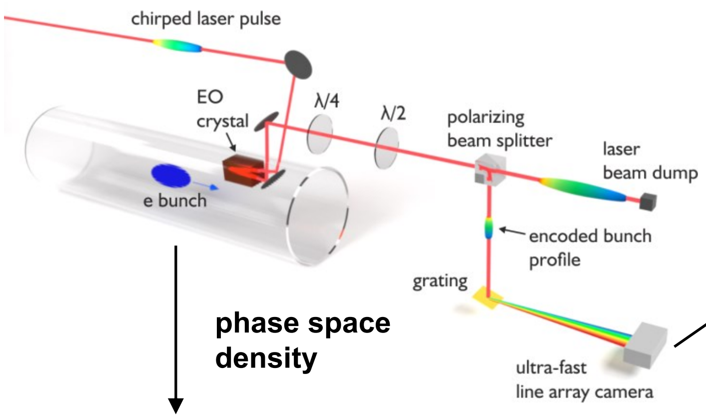


diagnostics



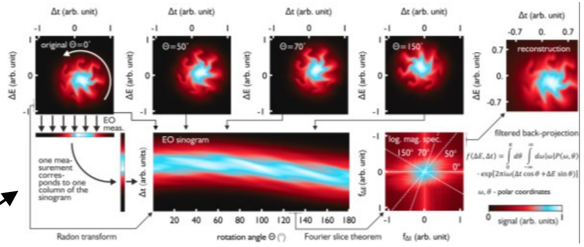
phase space density

Phase Space Tomography



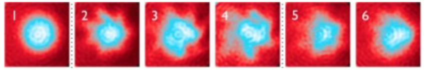
phase space density

phase space reconstruction with filtered back projection



simulation

experiment



SF et. al., "Revealing the dynamics of ultrarelativistic non-equilibrium many-electron systems with phase space tomography", preprint arXiv:1912.01323

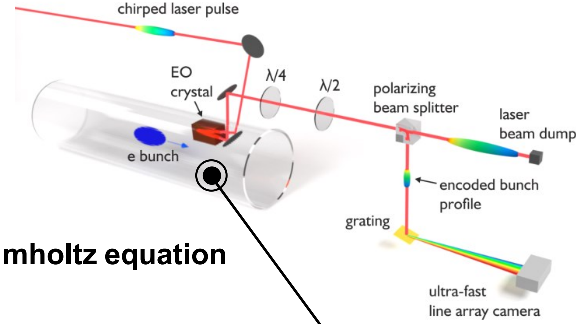
dynamics: Vlasov- Fokker-Planck

$$\frac{\partial \psi}{\partial \theta} + \frac{\partial H}{\partial p}\frac{\partial \psi}{\partial q} - \frac{\partial H}{\partial q}\frac{\partial \psi}{\partial p} = \beta \frac{\partial}{\partial p}\left(p\psi + \frac{\partial \psi}{\partial p}\right)$$

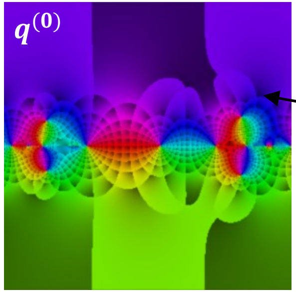
Questions

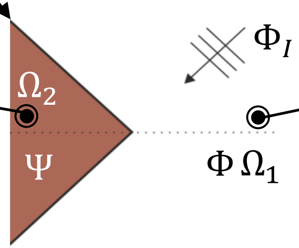
- **theoretical validation of the approximation (parameter dependence?)**
- **can we formulate a "specialized" filtered back projection**

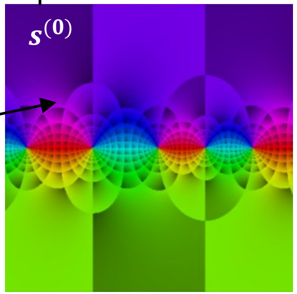
Waves



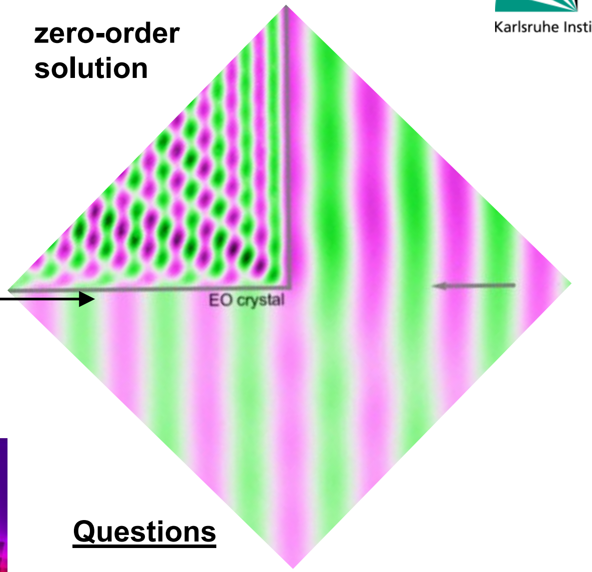
Helmholtz equation







zero-order solution



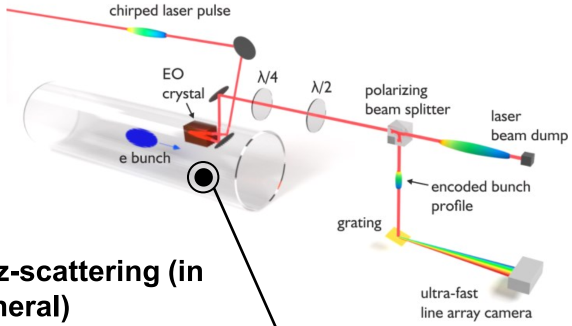
Solution: Wiener-Hopf + Sommerfeld Malyuzhinets technique

Nethercote et. al., "IMA Journal of Applied Mathematics 85.3 (2020): 421-466."

<u>Questions</u>

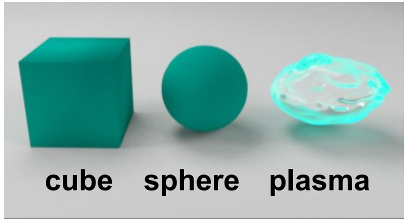
- **general properties of the solution**
- **connection to electron-bunch measurements with EO sampling**
- **reconstruction shape of an incoming TD-pulse possible?**
- **solution for: edges? two wedges? cube?**

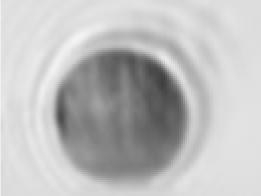
Spatial THz Tomography

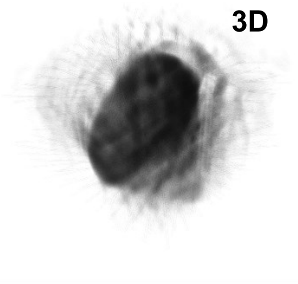


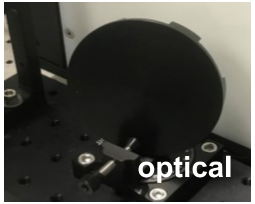
THz-scattering (in general)

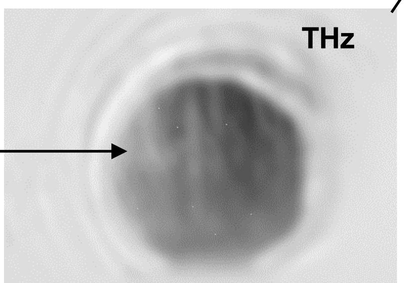
simple objects:











Questions

- **measure/describe simple shape/ sources like a plasma**
- **how to include wave phenomena for improved 3D-reconstruction**

Thank you for your attention!