

In-situ X-ray analysis of diamond formation in dynamically compressed glassy carbon

Mittwoch, 28. Januar 2026 17:00 (1 h 30m)

The structure of liquid carbon[1] and the formation of nanodiamonds under dynamic compression[2, 3] sparked scientific interest. The extreme conditions required were generated for a few nanoseconds using the HED-HIBEF instrument at EuXFEL[4] by the DiPOLE-100X laser. Laser-induced shock compression was utilised to compress glassy carbon, reaching Mbar pressures. For probing, X-ray Thomson scattering (XRTS) in forward direction achieved a resolution of ~ 1 eV, sufficient to observe changes of the plasmon shift. This observable depends on the plasmon frequency and information about the band gap[5, 6]. Complementary diagnostics, including X-ray diffraction (XRD) and a velocity interferometer system of any reflector (VISAR), infer a compressed diamond density of $\sim 3.8 \frac{\text{g}}{\text{cm}^3}$. This provides constraints for future plasmon-shift analysis which could offer insight into the electronic structure of diamonds at Mbar pressures.

- [1] Kraus, D. et. al. (2025). In: Nature 642. pp. 351-355.
- [2] Kraus, D. et al. (2017). In: Nat. Astron. 1. pp. 606-611.
- [3] He, Z. et al. (2022). In: Sci. Adv. 8. eabo0617.
- [4] Zastrau, U. et. al. (2021). In: J. Synchr. Rad. 28. pp.1393-1416.
- [5] Penn, D. R. (1962). In: Phys. Rev. 128, pp. 2093-2097.
- [6] Gamboa, E. J. (2016). In: IAEA. SLAC-Report.

Autor: LINDQVIST, Björn (Universität Rostock(UR) & Helmholtz-Zentrum Dresden-Rossendorf(HZDR))

Co-Autoren: Dr. PRESTON, Thomas (European XFEL); Prof. KRAUS, Dominik (Universität Rostock(UR) & Helmholtz-Zentrum Dresden-Rossendorf(HZDR)); Dr. HUMPHRIES, Oliver (European XFEL); EXPERIMENTAL TEAM P6656

Vortragende(r): LINDQVIST, Björn (Universität Rostock(UR) & Helmholtz-Zentrum Dresden-Rossendorf(HZDR))

Sitzung Einordnung: Poster Session 2