

## Physikalisches Kolloquium

# Exploring extreme states of matter with an ultra-bright X-ray free-electron laser

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In this talk, we will review recent progress in high-energy density physics using the world's brightest X-ray source, the Linac Coherent Light Source, SLAC's free electron X-ray laser. These experiments investigate laser-driven matter in extreme conditions where powerful X-ray scattering and imaging techniques have been applied to resolve ionic interactions at atomic (Ångstrom) scale lengths and to visualize the formation of dense plasma states [1, 2]. The major research areas include dynamic compression experiments of solid targets to determine structural properties and characterize phase transitions at conditions approaching the interior of planets. Another area studies extreme fields produced by high-intensity radiation where fundamental questions of strongly excited solids can be investigated [3]. Each of these areas takes advantage of the unique properties of the probing beam. They include small foci for achieving high intensity or high spatial resolution, high photon or electron flux for dynamic structure factor measurements in single shots, and high spectral bandwidth to resolve plasmon (Langmuir) waves or ion acoustic waves in dense plasmas. We will present new experimental data demonstrating several novel studies that test our fundamental understanding of matter in extreme conditions with data of sufficient accuracy to support or refute theoretical approximations. These advances have led to significant international competition and laid out the path for facility upgrades to explore ever more extreme states of matter.

[1] P. Sperling, E. J. Gamboa, H. K. Chung, E. Galtier, H. J. Lee, Y. Omarbakiyeva, H. Reinholz, G. Röpke, U. Zastrau, J. Hastings, L. B. Fletcher, and S. H. Glenzer, Phys. Rev. Lett. 115, 115001 (2015).

[2] B. B. L. Witte, L. B. Fletcher, E. Galtier, E. Gamboa, H. J. Lee, U. Zastrau, R. Redmer, S. H. Glenzer, and P. Sperling, Phys. Rev. Lett. 118, 225001 (2017).

[3] M. Mo, Z. Chen, R. K. Li, M. Dunning, B. B. L. Witte, J. K. Baldwin, L. B. Fletcher, J. B. Kim, A. Ng, R. Redmer, A. H. Reid, P. Shekhar, X. Z. Shen, M. Shen, K. Sokolowski-Tinten, Y. Y. Tsui, Y. Q. Wang, Q. Zheng, X. J. Wang, and S. H. Glenzer, Science 360, 1451-1454 (2018).

**Der Gast wird betreut von Frau Prof. Dr. Rethfeld**

**Gäste sind herzlich willkommen**

**Kaffeeauschank ab 17:00 Uhr**

**Montag, 15. Juli 2019, 17:15 Uhr**

**Gebäude 46 / Raum 46-270**