Experimental methods for warm dense matter research

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The talk will focus on the understanding the equation of state and dynamic processes behind transport properties of warm dense matter (WDM). The equation of state, electric conductivity, transport of heat and radiation in dense plasmas are responsible for the layer structure and convection in planets and stars, their formation or the dynamics of the dynamos inside their cores. Heat conductivity, particle stopping power, diffusion/species separation as well as mixing of plasmas in the correlated regime are crucial to successful implementation of several approaches to the ICF approach to 'clean' energy production. Due to the complicated nature of WDM owing to strong quantum and correlation effects, both theoretical and experimental description of the thermodynamic properties remains very limited. Experiments studying these processes have now been demonstrated at high power laser facilities and detailed measurements including ultra-fast probes on pico and femtosecond time scales have been performed. Novel diagnostic methods with excellent temporal and spatial resolution have been developed for these purposes. This talk will provide an overview of experimental and diagnostic methods used during laser experiments to study non-thermal melting, electron transport, diffusion and phase separation of species, proton stopping powers, heat and electric conductivity with specific examples of past experiments.

References

[1] K. Falk, *"Experimental Methods for Warm Dense Matter Research"*, HLPSE **6**, 59 (2018)