European XFEL Science Seminar

Tuesday, 5th March 2019, 13:00 ***(Light refreshments will be served at 12:30)***
Campus Schenefeld, XHQ, room E1.173

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Probing C-H mixtures at conditions relevant to the interiors of giant planets, brown dwarfs and stars

Carbon-hydrogen (C-H) mixtures at extreme pressure and temperature conditions are highly relevant for the interiors of icy giant planets like Neptune and Uranus where pressures of several Mbar are present in their deep interiors. Moreover, various warm dense matter and dense plasma states up to the Gbar regime can be found inside brown dwarfs and small stars. Experiments at state-of-the-art facilities allow for insights of unprecedented quality into such extreme states of matter. At the Linac Coherent Light Source (LCLS), we have investigated C-H mixtures at conditions comparable to planetary interiors [1,2], showing structural transitions and chemical activity applying various X-ray diagnostic techniques in one experiment. In other experiments, performed at the National Ignition Facility and using spectrally resolved X-ray scattering in combination with radiography, we have investigated the ionization balance of warm and hot dense C-H at conditions that are comparable to the interiors of brown dwarfs or small stars. These results indicate that, particularly for mixtures, standard ionization models may require revisions in the regime of warm and hot dense matter [3]. Similar physics will soon be probed at the HED instrument of European XFEL [4].

[1] D. Kraus et al., Nature Astronomy **1**, 606-611 (2017).
[2] N. J. Hartley et al., Physical Review Letters **121**, 245501 (2018)
[3] D. Kraus et al., Physical Review E **94**, 011202(R) (2016).
[4] D. Kraus et al., Plasma Physics and Controlled Fusion **61**, 014015 (2019)

Host: Karen Appel