

Einladung zum
ICP-Kolloquium (online)
SONDERTERMIN

via zoom

<https://us06web.zoom.us/j/88922454845?pwd=WFNueEI0ajl0UzFkWTRWdUljS3ZIQT09>

Meeting-ID: 889 2245 4845

Kenncode: 799123

Prof. Dr. Patrick Huber
Technische Universität Hamburg und
Deutsches Elektronen-Synchrotron DESY

hält am

Freitag, 03.12.2021, 14:00 Uhr

einen Vortrag über das Thema:

**“Water confined in nanopores:
What do we know about it and what is it good for?”**

Interessenten sind herzlich eingeladen.

Prof. Dr. C. Holm
Apl. Prof. Dr. R. Hilfer
Apl. Prof. Dr. M. Fyta

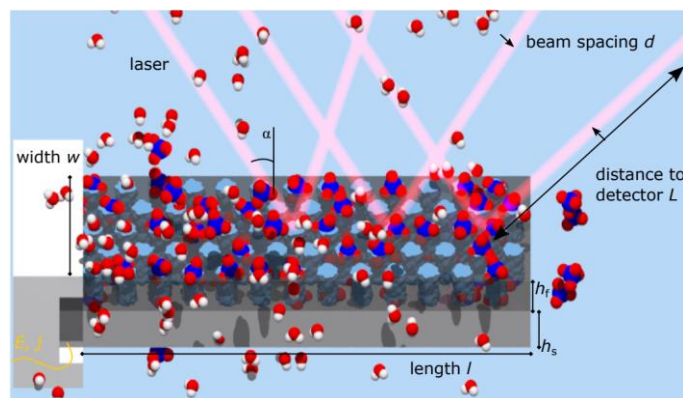
Water confined in nanopores: What do we know about it and what is it good for?

Patrick Huber

Technische Universität Hamburg and
Deutsches Elektronen-Synchrotron DESY

In nanoporous media the geometrical confinement and pore wall-fluid interactions as well as complex pore morphologies may significantly alter water's physico-chemical equilibrium and non-equilibrium properties, causing, for example, the molecular structuring of the fluid, huge negative Laplace pressures in the liquid and changed shear viscosities.

In the first part of my talk I will present opto-fluidic, X-ray and neutron scattering experiments on capillarity-driven transport, self-diffusion dynamics of water and aqueous electrolytes in nanoporous solids [1, 2] as well on the interplay of water's capillarity with the confining solids' elasticity [3, 4]. The observations on the effective, porous-medium scale will be related to the single-nanopore fluid properties [2], also by resorting to computer simulations. In the second part of my talk I will exemplify that exploiting water's peculiar nanofluidics in combination with self-organized porosity in solids offers an entirely novel design space for sustainable, active integrated materials with functional diversity. In particular, I will present porous materials with electrically switchable wettability and hydraulic permeability [5] as well as large electrochemo-mechanical actuation for potential applications in Lab-on-a-Chip fluidics, sensorics, water filtration and energy conversion [5,6,7,8].



Laser cantilever bending experiments reveal reversible deformation of nanoporous silicon upon electro-sorption in aqueous electrolytes [8].

References: [1] *Capillary rise of water in hydrophilic nanopores*, S. Gruener and T. Hofmann and D. Wallacher and A.V. Kityk, P. Huber, Phys. Rev. E 79, 067301 (2009). [2] *Dynamics of water confined in mesopores with variable surface interaction*. A. Jani, M. Busch, J.B. Mietner, J. Ollivier, M. Appel, B. Frick, J.M. Zanotti, P. Huber, M. Fröba, D. Morineau. J. Chem. Phys. 154, 094505 (2021). [3] *Elastic response of mesoporous silicon to capillary pressures in the pores*, G.Y. Gor, L Bertinetti, N. Bernstein, T Hofmann, P. Fratzl, P. Huber, Appl. Phys. Lett. 106, 261901 (2015). [4] Thelen, M.; Bochud, N.; Brinker, M.; Prada, C.; Huber, P. *Laser-excited elastic guided waves reveal the complex mechanics of nanoporous silicon*. Nat. Comm. (2021, in press). [5] *Switchable imbibition in nanoporous gold*, Y. Xue, J. Markmann, H. Duan, J. Weissmüller, P. Huber, Nat. Comm. 5, 4237 (2014). [6] *Giant electrochemical actuation in a nanoporous silicon-polypyrrole hybrid material*. M. Brinker, G. Dittrich, C. Richert, P. Lakner, T. Krekeler, T.F. Keller, N. Huber, P. Huber. Sci. Adv. 6 eaba1483 (2020). [7] *Giant electrochemical actuation in a nanoporous silicon-polypyrrole hybrid material*. M. Brinker, G. Dittrich, C. Richert, P. Lakner, T. Krekeler, T.F. Keller, N. Huber, P. Huber. Sci. Adv. 6 eaba1483 (2020). [8] *Wafer-Scale Electroactive Nanoporous Silicon: Large and Fully Reversible Electrochemo-Mechanical Actuation in Aqueous Electrolytes*. M. Brinker and P. Huber. Adv. Mater. (2021).