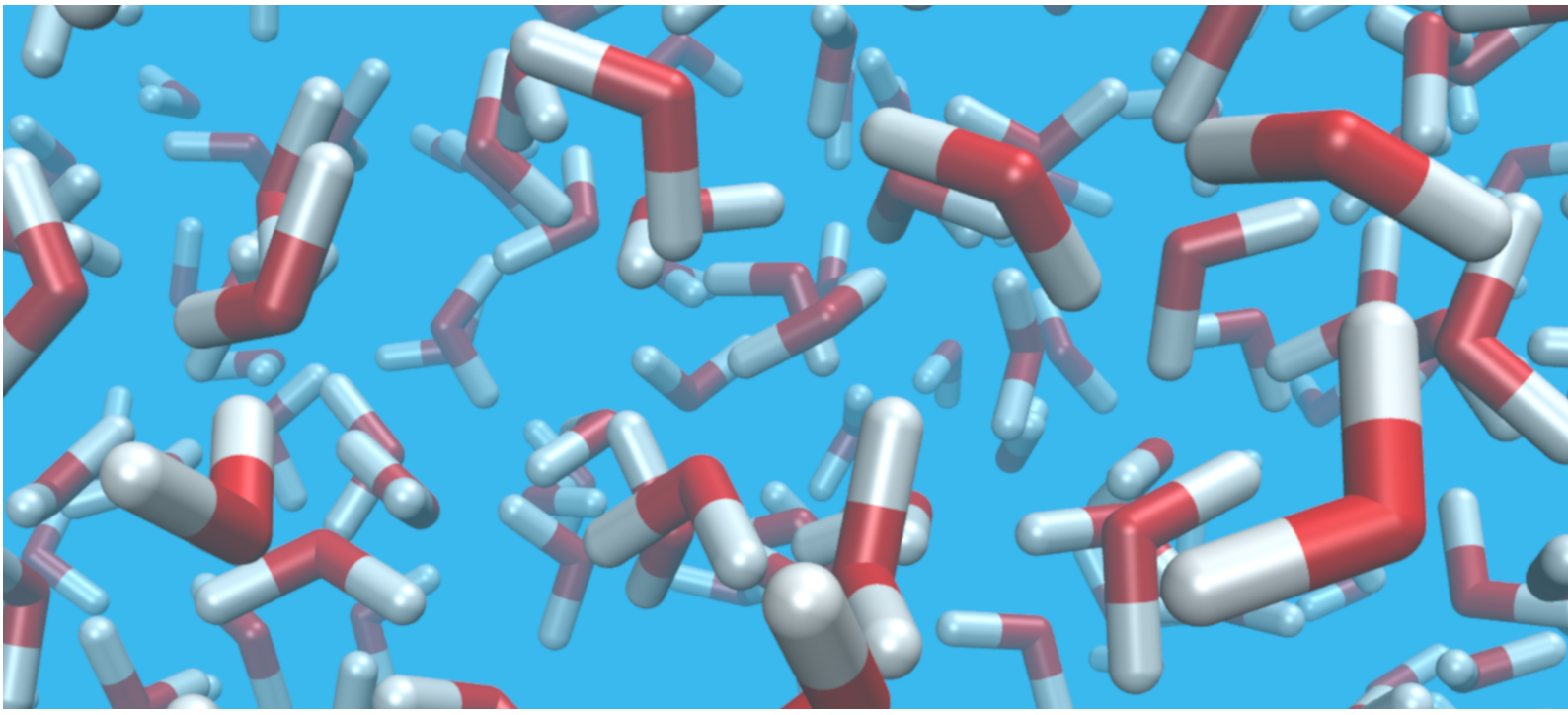
DESY WATER WEEK 2020

25-28 February 2020
Programme booklet



CMWS
Centre for Molecular Water Science

DESY.

DESY WATER WEEK 2020

Schedule – CMWS Sessions

Tuesday, 25 February

09:00	*Free time*	*Possibilities for Working Group Meetings and Discussions*
12:00	Registration and get together	*CSSB foyer*
14:00	**Welcome and Introduction**	*CSSB lecture hall*
14:30	**Status White Paper and Pillar presentations**	*CSSB lecture hall*
15:45	*Coffee break*	
16:15	**Discussion on White Paper updates**	*CSSB lecture hall*
18:00	Reception	*CSSB foyer*
19:30	Public Evening Lecture (in German)	*DESY auditorium*

Wednesday, 26 February

08:45	**Early Science Programme**	*CSSB lecture hall*
10:30	*Coffee break and group photo*	
11:00	**CMWS: Status and Future**	*CSSB lecture hall*
	Welcome	H. Dosch (DESY)
	Introduction	G. Grübel (DESY)
	Scientific talks on CMWS research	A. Nilsson (U Stockholm), R. Santra (DESY/U Hamburg), A. Pearson (U Hamburg)
13:15	*Lunch*	
14:00	**Working groups: Infrastructure and Organization**	*various seminar rooms*
15:30	*Coffee break*	
16:00	**Report from Working groups, summary and next steps**	
18:30	Workshop dinner	*DESY canteen*

CMWS Centre for Molecular Water Science

DESY.

Schedule – Research Course 2020

	Thursday, 27 February		FLASH seminar room (Bldg. 28c)
09:00	*Welcome*		
09:10	**Austen Angell**	*Arizona State University*	Anomalies in supercooled and high pressure water - and sharp liquid-liquid (or liquid-glass) transitions in water-rich ideal binary solutions
09:55	**Anders Nilsson**	*Stockholm University*	Anomalies of water; investigations into no-mans land using x-ray lasers
10:40	*coffee break*		
11:00	**Thomas Kühne**	*Paderborn University*	Tumbling with a limp: local asymmetry in water's hydrogen bond network and its consequences
11:45	**Frédéric Caupin**	*University Lyon 1*	Anomalies of water: thermodynamic rules, measurements at negative pressure, and a two-state interpretation
12:30	*Lunch*		
13:45	**Max Wilke**	*Potsdam University*	The Role of H_2O in Dynamics and Evolution of the Solid Earth
14:30	**Sebastian Hartweg**	*SOLEIL*	Electron scattering in gas phase water clusters and predictions for the liquid phase
15:15	**Nønne Prisle**	*University of Oulu*	Atmospheric water surfaces: from synchrotron experiments to climate models
16:00	*coffee break*		
16:30	**Andreas Stierle**	*DESY*	Water at interfaces and in confinement
17:15	**Pascale Roy**	*SOLEIL*	tba
18:30	Poster Session		

	Friday, 28 February		FLASH seminar room (Bldg. 28c)
09:00	**Nils Huse**	*Hamburg University*	Ultrafast dynamics in water: Spectral probes from the far-infrared to the X-ray regime
09:45	**Martin Schroer**	*EMBL*	Biological-relevant water studied by modern X-ray methods
10:30	*coffee break*		
11:00	**Henrike Müller-Werkmeister**	*Potsdam University*	Functional water molecules in protein structures – Insights from Serial Crystallography at XFELs and Synchrotrons
11:45	**Sadia Bari**	*DESY*	Relaxation mechanisms in gas-phase biomolecules
12:30	*Closure*		

General information

Oral sessions	The oral sessions will be held in the CSSB lecture hall (Bldg. 15) on Tuesday, 25 February and Wednesday, 26 February. The break-out session will take place in different locations onsite that will be announced before the session. The report of the break-out session and the Research Course sessions will take place in the FLASH seminar room (Bldg. 28c).
Working groups	The pillar working groups will take place in CFEL sem. rooms I-III (Bldg. 99), FLASH seminar room (Bldg. 28c), and seminar room 204 in Bldg. 49. The distribution of the pillars to the rooms will be communicated during the CMWS session on Wednesday, 26 February.
Poster session	The poster session will take place in the FLASH seminar room (Bldg. 28c) on Thursday 18:30. There will be barbeque and drinks for all participants.
Registration	The registration will start on Tuesday, 25 February 2020 at 12:00 in the CSSB lobby (Bldg. 15).
Public evening lecture	As part of the WATER WEEK 2020, a public evening lecture will be held by Mojib Latif (GEOMAR Kiel) on “Die Rolle der Ozeane im Klimawandel” (in German) in the DESY auditorium (Bldg. 6).
Social event	The conference dinner will take place on Wednesday, 26 February 2020 at 18:30 at the DESY canteen.
Meals	*Breakfast* If you stay at the DESY guest house you may have breakfast at the DESY cafeteria (opens at 07:00, building 9) at your own expenses. *Lunch* There will be a light work lunch parallel to the working groups in Wednesday, 26 February. On Thursday and Friday, you may have lunch at the DESY canteen (building 9) and/or the Café CFEL (building 99) at your own expenses.
Supermarkets	LIDL: From the main gate at Notkestrasse turn right and follow the street (700–800m). ALDI and DENN’S BIOMARKT: From the main gate at Notkestrasse walk straight down the street "Zum Hünengrab". You will find a bakery, drugstore and other shops as well as restaurants in the vicinity.
ATM	You will find a cash machine in the foyer of the DESY canteen (Bldg. 9).
DESY WLAN	An eduroam network is available on the DESY campus. Guests without eduroam access will be mapped to “DESY-Guest”. More information can be found online.
Contact	For any questions, please contact us via cmws@desy.de.

CMWS
Centre for Molecular
Water Science

DESY.

Research Course

Abstracts

Anomalies in supercooled and high pressure water - and sharp liquid-liquid (or liquid-glass) transitions in water-rich ideal binary solutions

Austen Angell

Arizona State University

Computer simulations based on the TIP4P-2005 potential give a good account of the behavior of water in both its stable liquid and crystal states. However, in deeply supercooled water, quantities calculated with this potential simply fail to keep up with the power-law increases, with decreasing temperature, in fluctuation-based properties like compressibility and heat capacity. We contrast this failure, with the relative success of a newer pair potential, the so-called WAIL potential (1), which yields a 2nd critical point at about 50.0 MPa and 205K, and an extension of the (lower pressure) "Widom" line that cuts ambient pressure at 225K (-48°C) close to the Speedy singularity temperature (228K). We discuss the use of isochore crossing phenomena(2) in the search for indications of where the critical point for real water might lie, and then turn to a new type of study in which we can decouple the ice formation kinetics from the thermodynamic anomalies using novel "ideal" solutions (3). With these, we can pass continuously from the high temperature ("normal") domain down to the glassy state without destroying the thermodynamic anomalies. For the highest water content non-crystallizing solutions, these isobars reveal a sharp, essentially first order, transition from the heat capacity per gm of water in the solution to the heat capacity of glassy water (3)- as is also predicted by two state models of pure water that fit the pure water data above the usual "no-man's land" cut-off (4). Precise FTIR data provide evidence that the structures between which this sharp transition occurs are highly similar to those of high density amorphous water and low density amorphous water, respectively (5). The transition is reversible and we analyze its significance.

Time permitting, we will digress into a short discussion of tellurium-based liquid alloys that exhibit anomalies that are uncannily similar to those of supercooled water but in which the L-L transition (usually observed to be continuous at ambient pressure) is also a metal-to-semiconductor transition. This latter is currently being shown to be of great relevance to the understanding and construction of ultra-fast switching devices, actuated by heat pulses, for rewritable digital memory devices (PCMs). Plots of the Tm-scaled transition temperature against a "metallicity" parameter trace the temperature of this transition from far above the melting point in low metallicity cases, to supercooled conditions like those in water, for all the known PCMs (6). We discuss the reasons for this coincidence and the importance of "fast" experiments to detect the transition and its order, directly.

(1) Y.-P Li, J.-C. Li, and F. Wang, PNAS, 110,12209-12212 (2013).
(2) P. H. Poole, I. Saika-Voivod, and F. Sciortino, J. Phys.: Condens.Matter 17, L431 (2005).
(3) Z.-F. Zhao and C. A. Angell Angew. Chem. Int. Ed. 55, 1 – 5 (2016).
(4) V. Holten and M. A. Anisimov, Scientific Reports 2 : 713 (2012).
(5) S. Woutersen, B. Ensing, M. Hilber, Z.-F Zhao C. A. Angell, Science (2018).
(6) S. Wei, P. Lucas, Angell, Phys. Rev Appl. 7, 034035 (2017). Bull. Mater. Res. Soc.,(2019) .

Tumbling with a limp: local asymmetry in water's hydrogen bond network and its consequences

Thomas Kühne

University of Paderborn

Ab initio molecular dynamics simulations of liquid water under equilibrium ambient conditions, together with a novel energy decomposition analysis, have recently shown that a substantial fraction of water molecules exhibit a significant asymmetry between the strengths of the two donor and/or the two acceptor interactions. We refer to this recently unraveled aspect as the "local asymmetry in the hydrogen bond network". We discuss how this novel aspect was first revealed, and provide metrics that can be consistently employed on simulated water trajectories to quantify this local heterogeneity in the hydrogen bond network and its dynamics. We then discuss the static aspects of the asymmetry, pertaining to the frozen geometry of liquid water at any given instant of time and the distribution of hydrogen bond strengths therein, and also its dynamic characteristics pertaining to how fast this asymmetry decays and the kinds of molecular motions responsible for this decay. Following this we discuss the spectroscopic manifestations of this asymmetry, from ultrafast X-ray absorption spectra to infrared spectroscopy and down to the much slower terahertz regime.

Anomalies of water: thermodynamic rules, measurements at negative pressure, and a two-state interpretation

Frédéric Caupin

University Lyon 1

Water exhibits many anomalies, the most famous being arguably its density maximum near 4 °C at ambient pressure. Thermodynamics dictates that this density maximum causes other anomalies in compressibility and sound velocity at higher temperature. In contrast, the behavior of liquid water at low temperature, including the supercooled region, is still an open question. An intriguing hypothesis, supported by simulations, is that a first-order phase transition between two distinct liquids might be hidden deep in the supercooled region (1,2). The first-order transition would terminate at a critical point, and liquid water we are used to would be the supercritical fluid corresponding to this transition. We will discuss the thermodynamic consequences of such a liquid-liquid critical point.

To learn more about the origin of water's anomalies, we study the liquid at negative pressure. Negative pressure is a metastable state of mechanical tension, with the molar volume of the liquid up to 10 % larger than stable water at ambient conditions. By measuring the sound velocity in water at negative pressure, we have reconstructed its equation of state and revealed new anomalies consistent with the liquid-liquid critical point scenario (3).

Finally, we will describe a model which assumes the existence of a liquid-liquid transition, and, by treating water as a regular solution of two interconverting species, provides a quantitative description of experimental thermodynamic properties of water from 400 MPa and down to −140 MPa, and from 300 K down to the temperature of spontaneous ice nucleation (4).

(1) P. H. Poole, F. Sciortino, U. Essmann, H. E. Stanley, Nature 1992, 360, 324.
(2) P. Gallo et al., Chem. Rev. 2016, 116, 7463-7500.
(3) V. Holten, C. Qiu, E. Guillerm, M. Wilke, J. Ricka, M. Frenz, and F.Caupin, J. Phys. Chem. Lett., 2017, 8, 5519-5522.
(4) F. Caupin and M. A. Anisimov, J. Chem. Phys. 2019, SCH2O2019, 034503.

The Role of H_2O in Dynamics and Evolution of the Solid Earth

Max Wilke

University Potsdam

The lecture will give an introduction and overview on the role of H_2O in processes of the solid Earth. It will be discussed, how H_2O has entered planet Earth, how it can be incorporated to the phases of the solid Earth and how it affects the dynamics of the Earth?s interior. It will be introduced, how the global cycling of H_2O between reservoirs within the Earth works. Particular focus will lie on the role of H_2O in geochemical cycling and element enrichment processes that are of paramount importance for the formation of the continental crust and ultimately lead to the formation of ore deposits. Finally, the lecture will discuss experimental and analytical methods that may be applied to study the properties and behaviour of minerals and rocks and their interactions with H_2O under conditions prevailing in the inner Earth.

Electron scattering in gas phase water clusters and predictions for the liquid phase

Sebastian Hartweg

Synchrotron SOLEIL

Electron scattering processes in liquid water are of fundamental importance for an in-depth modelling of radiation damage to biological tissue (1), as well as for a detailed description of solvated electrons (2,3) and a quantitative interpretation of liquid-jet photoelectron spectra (3).

In my talk I will present size- and angle-resolved photoelectron spectra of gas phase neutral water clusters $(H_2O)n$ with $1<n<700$, used to study electron scattering effects. For small water clusters with $1<n<20$ (4) measurements of photoemission anisotropies were performed with a photoelectron photoion double imaging (i2PEPICO) spectrometer at the DESIRS beamline of Soleil synchrotron (5,6). For a given photon energy we find a systematic decrease of the photoelectron anisotropy up to a cluster size of 5-6 molecules and convergence of the anisotropy for larger clusters. We suggest that this remarkable convergence results from a photoionization process that is fully described by a unit of 5-6 molecules. The converged photoemission anisotropies are used in combination with electron transport scattering calculations (7) to predict anisotropies for liquid bulk measurements and large water clusters. While the predictions for the liquid bulk agree reasonably well with experiments (8), our measurements on large water clusters using high harmonic generation light source (9) deviate strongly from the condensed phase predictions. This deviation is explained by a cluster specific scattering behavior intermediate between the gas phase and the condensed phase.

In addition to the work on water clusters, I will present an outlook on future experiments studying nano-solvation and condensation effects using angle-resolved photoelectron spectroscopy.

(1) E. Alizadeh et al., Annu. Rev. Phys. Chem. 66, 379, 2015
(2) J. M. Herbert et al., Annu. Rev. Phys. Chem. 68, 447, 2017
(3) D. Luckhaus et al., Sci. Adv. 3, 163224, 2017
(4) S. Hartweg et al., Phys. Rev. Lett. 118, 103402, 2017
(5) G. A. Garcia et al., Rev. Sci. Instrum. 85, 053112, 2013
(6) L. Nahon et al., J. Synchrotron Rad. 19, 508, 2012
(7) R. Signorell et al., Chem. Phys. Lett. 658, 1, 2016
(8) J. Nishitani et al., Struct. Dyn. 4, 044014, 2017
(9) T. Gartmann et al., Phys. Chem. Chem. Phys. 20, 16364, 2018.

Atmospheric water surfaces: from synchrotron experiments to climate models

Nønne Prisle

University of Oulu

Water is vital to physical, chemical and biological processes across the Earth's environment. In our atmosphere, water is present both in the gas phase and as condensed solid or liquid matter in the form of snow, ice, clouds, and aerosols. Here, water is in constant transformation across a wide range of states, as air moves through greatly varying conditions in the atmospheric circulation.

Aerosols play key roles in climate and atmospheric chemistry, by absorbing, scattering and reflecting radiation, serving as condensation nuclei for cloud formation, and proving reaction media for condensed phase chemistry. By combining classical thermodynamics with quantum chemistry and novel experimental methods, we study molecular level details of representative model systems for aqueous aerosols and cloud drops in the atmosphere. Using experimental approaches relying on synchrotron radiation based spectroscopy, imaging, and scattering, we have discovered new details of surface composition, equilibria, and surface tension in finite sized condensed systems, with potential to profoundly impact atmospheric chemistry and climate predictions.

Water at Interfaces and in Confinement

Andreas Stierle

DESY & University of Hamburg

Water plays an important role as reactant and solvent in catalytic and electrochemcial processes related to energy conversion and corrosion. Further on, it exhibits altered interaction properties in confinement. In my presentation, I will focus on recent experimental results addressing the interaction of water with oxide surfaces and graphene, which we obtained at the DESY NanoLab with our multimethod approach, ranging from Fourier transform infrared reflection absorption spectroscopy (FTIRRAS) to x-ray reflectometry, surface x-ray diffraction and scanning probe microscopy.

We have investigated the interaction of water vapor with the magnetite Fe_3O_4(001) surface at room temperature in a pressure range from 10^{-8} mbar to 10^{-2} mbar (1). From surface x-ray diffraction results, we can infer that above 10^{-4} mbar water vapor pressure a subsurface rearrangement of Fe cations takes place, resulting in the formation of Fe hydroxide islands on the surface, accompanied by water dissociation. Exposure of the clean magnetite (001) surface at room temperature leads in contrast to the formation of cation vacancies, which cluster in the form of 2D holes, induced by H_2O formation from lattice oxygen.

We have studied water in 1D confinement by the investigation of water overlayers on strontium titanate (SrTiO3) as a function of water vapor pressure and temperature by x-ray reflectometry. At room temperature and exposure to air, we observed the formation of a 1.6 nm thick water film, which exhibits a density 20% higher than bulk water. The water layer thickness cannot be explained in terms of conventional Lifshitz theory. A 2D confinement of water molecules can be achieved at low temperatures by adsorption of water molecules on the graphene / Ir(111) Moire structure with 2.5 nm pitch. In this way, amorphous solid water clusters with 1 nm diameter can be stabilized, containing around 40 water molecules. Our extended FTIRRAS study gave evidence, that the bond length distance distribution in the clusters is reduced, as compared to amorphous solid water films (2). In addition, we find that the water molecules point with their oxygen side towards the slightly p doped graphene.

(1) B. Arndt, M. Creutzburg, E. Grånäs, S. Volkov, K. Krausert, A. Vlad, H. Noei, A. Stierle, J. Phys. Chem. C 123, 26662 (2019).
(2) R. Gleißner, M. Creutzburg, H. Noei, A. Stierle, Langmuir 35, 11285 (2019).

Biological-relevant water studied by modern X-ray methods

Martin A. Schroer

EMBL Hamburg

The uniqueness of water might be the most obvious when looking at its role for the establishing of Life. Without water we cannot imagine life to exists on Earth. While on the one side the properties of water are affecting the properties and function of biological relevant structures, on the other side also the biological macromolecules and assemblies do influence water. Understanding these interactions on a microscopic length scale is therefore crucial to widen our knowledge of the processes of Life.

Modern X-ray methods do allow to shed light on these interactions as X-ray probe the relevant length scales involved. Here, e.g., solution small angle X-ray scattering (SAXS) can give insight into the structure of biological macromolecules and, in particular, how hydration and solvation can change it.

In my presentation I plan to discuss some general aspects of the biological role of water and show how X-ray methods can be used study the structure biological-relevant water-based systems on several examples. I will cover studies dilute protein solutions, concentration protein solutions and co-solvent mixtures, in which the properties of molecular water play an important role.

Functional water molecules in protein structures – Insights from Serial Crystallography at XFELs and Synchrotrons

Henrike Müller-Werkmeister

U Potsdam

Water is present during any biochemical reaction as it is the ubiquitous solvent in all living systems. For many decades structural studies of proteins have focused on resolving their three-dimensional structure. The role of water in driving biochemical reaction, i.e. in enzymatic catalysis, is more difficult to access experimentally and only starts to become apparent from recent experiments.

In my talk I will review protein structure determination from (traditional) X-ray crystallography, and the changes crystallography is currently undergoing, driven by the availability of XFELs. The ability to record room-temperature structures with low to no radiation damage using serial femtosecond crystallography (SFX, at XFELs) or serial synchrotron crystallography (SSX) is rapidly providing new insights into protein structures and functionally relevant water networks. Further, time-resolved studies are emerging, and first examples demonstrate the intricate interplay between the protein structure, ligands and functional water molecules – thereby demonstrating that indeed all together are necessary for a biochemical reaction.

Relaxation mechanisms in gas-phase biomolecules

Sadia Bari

DESY

Investigating the interaction of light with biologically relevant molecules has gained interest for a wide variety of research fields including photochemical reactions such as light harvesting as well as radiation damage in proteins and DNA related to cutting-edge cancer treatment techniques. However, in the condensed phase, disentangling direct and indirect radiation effects is often difficult. Electrospray ionization (ESI) introduces biomolecular ions from solution into the gas phase, allowing for studies of molecular systems in a well-defined state, for example also with a defined number of attached water molecules.

The coupling of ESI sources with synchrotrons and free-electron lasers (FELs) opens the way to the investigation of the electronic structure of biomolecular systems and of a fine description of their relaxation mechanisms in the VUV and soft X-ray energy range. The wide-ranging photon energy available at the synchrotrons enables systematic studies of ionization and dissociation as a function of the photon energy. Inner-shell excitations provide a localized site of energy deposition. The extremely high photon flux and fs pulse duration offered by FELs allow studying the molecular properties in intense fields. In addition, a pump-probe scheme allows the study of the dynamics of charge migration and charge transfer within gas-phase biomolecules.

Relaxation mechanisms in gas-phase biomolecules, e.g. peptides and proteins, will be presented.

List of posters

Poster session

No.	Name	Title
1	AL HADDAD, Andre	
2	ALBERT, Thies Johannes	Structural dynamics in laser-generated liquids studied by time-resolved X-ray and electron scattering
3	ARTEMOV, Vasily	Dynamical structure of water by dielectric and infrared spectroscopies: a role of ultrafast sub-picosecond proton exchange
4	BACHE, Michael	Could a device used for CaCO3 de-scaling change the properties of water itself ?
5	BERKOWICZ, Sharon	Exploring the Structural Dynamics of Supercooled Water
6	BIEKER, Helen	Photophysics of hydrogen-bonded clusters
7	BRESSLER, Christian	Aqueous Solvation Dynamics with New Observables
8	BREYNAERT, Eric	Water as tuneable solvent : A perspective
9	CHEN, Yuan	Hydrogen bonding of water from simulations
10	CHOI, Jinhyuk	Structuration of water in microporous CAU-10-H under high pressures
11	COLAIZZI, Lorenzo	Angle-resolved Photoelectron Spectroscopy of large Water Clusters ionized by an XUV Comb
12	DÖRNER, Simon	Near edge X-ray absorption mass spectrometry on peptides in the gas phase: From site-specific excitation to site-selective dissociation.
13	ELBERS, Mirko	X-ray Raman scattering study of hydrothermal fluids: The case of aqueous sodium chloride solution
14	ESMAEILDOOST, Niloofar	Ice nucleation in supercooled water droplets
15	FARLA, Robert	Studies on the role of water in Earth materials using the LVP at P61B
16	FILIZ, Volkan	Polymeric Membranes - Materials and Processes for liquid-phase separations
17	FRAXEDAS, Jordi	The role of water interfaces in the self-sustained motion of nano-objects
18	GIOVANNETTI, Gaia	A CEP-stable, multi-mJ OPA for attosecond pulse generation in the soft-X
19	GOPAKUMAR, Geethanjali	
20	GORSHUNOV, Boris	Electrodipolar lattice of nanoconfined water molecules: excitations, phase states and phase transitions

21	HÖVELMANN, Svenja	Investigation of the structure of photoswitchable lipid monolayers
22	HWANG, Huijeong	Pressure and heat induced water insertion of kaolin group minerals
23	JANI, Aicha	Water Confined in Periodic Silicates and Organosilicates: A Quasielastic Neutron Scattering Study
24	JÖNNSON, Olof	Ultrafast non-thermal heating of water initiated by an X-ray Free-Electron Laser
25	KIRCHBERG, Henning	Nonequilibrium Quantum Solvation
26	LADD PARADA, Marjorie	Ices and supercooled water as seen by X-rays
27	LEISNER, Thomas	Lab studies on the nucleation of ice on meteoric smoke nanoparticles
28	LI, Hailong	Interfacial premelting of ice in nano composite materials
29	LIN, Jack	CCN activity and surface tension of organic-salt mixtures predicted from two models of the droplet surface
30	MA, Shuailing	Acoustic Emissions Testing in the LVP to Explore Dehydration-induced Embrittlement
31	MALTSEVA, Daria	Interaction of the TRPML1 ion channel's N-terminus with biomembranes
32	MATLIS, Nicholas	Compact electron and x-ray source powered by THz radiation
33	MARKMANN, Verena	Shear-induced ordering in liquid μ-jets revealed by x-ray cross correlation
34	NOEI, Heshmat	Interaction of Water with Graphene/Ir(111) Studied by Vibrational Spectroscopy
35	NOPENS, Martin	Wood-Water-Interactions
36	OSTERHOFF, Markus	Cavitation dynamics: Bubble growth measured at European XFEL
37	ROSSI, Giulio Maria	Parametric Waveform Synthesizer for Attosecond Science
38	RUSSINA, Margarita	Cooperative dynamics in liquids and highly viscous melts
39	SAAK, Clara	TBD
40	SANCHEZ CALZADO, Juan	Water Imbibition-induced Deformation Dynamics in Nanoporous Media
41	SCHAUERMANN, Swetlana	Water interaction with iron oxide
42	SCHUBERT, Kaja	A gas-phase soft X-ray study on the metal active site of metalloporphyrins and metalloproteins
43	SCHWARZ, Julius	X-Ray Absorption Spectroscopy of Protonated Waterclusters and Solvated Ions

44	SOLDATOV, Mikhail	The interaction of Cu complex photodynamic therapy agents with water molecules: XANES spectroscopy and DFT simulations
45	THORWART, Michael	Nonequilibrium quantum dynamics in a time-dependent solvent
46	TRINTER, Florian	Photoemission from Liquid Jets: New Developments
47	UNGER, Isaak	Investigating the Surface of Free-Flying Aerosol with XPS
48	WANG, Xijie	Liquid Phase MeV-UED @ SLAC
49	ZALDEN, Peter	Femtosecond X-ray diffraction reveals a liquid-liquid phase transition in phase-change materials

DESY Campus map