



北京大学量子材料科学中心

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量子物质名家讲堂

Quantum Matter Distinguished Lecture Series

Molecular Mechanics of Aqueous Interfaces: from Ångström Confinement to Electric Double Layer

Mischa Bonn

马克斯·普朗克聚合物研究所

Time: 10:00 am, Nov.24, 2025 (Monday)

时间: 2025年11月24日 (周一) 上午10:00

Venue: Room W301, Physics building, Peking University

地点: 北京大学物理楼, 西301思源报告厅

Abstract

Understanding how water, ions, and surfaces interact across length scales is central to electrochemistry, nanofluidics, and catalysis. Across three studies, we established a molecular view of structure and dynamics at aqueous interfaces under confinement and electrostatic perturbation. We have demonstrated that, down to the angstrom-scale confinement, interfacial effects entirely determine the organization of confined water, disrupting bulk-like hydrogen bonding and producing asymmetric environments due to wall contact [Nature Commun. 16, 7288 (2025)]. These findings establish that nanofluidic behavior is governed not by the confined volume, but by its bounding interfaces. We extended this picture to show that even nominally neutral materials, such as hexagonal boron nitride, acquire a spontaneous surface charge at the aqueous interface [J. Am. Chem. Soc. 147, 30107 (2025)]. This intrinsic charging, observed also for other solids, reveals that the formation of an electric double layer (EDL) is nearly universal at solid-liquid boundaries. Finally, we resolved the ultrafast dynamics of the aqueous EDL using femtosecond-resolved optical spectroscopy, showing that ionic rearrangements occur within tens of picoseconds — faster than diffusion-limited models predict [Science 388, 405 (2025)]. Together, these studies provide a molecularly consistent understanding of how interfacial polarization, confinement, and charge collectively define water's behavior in nanofluidic and electrochemical environments.

About the speaker

Mischa Bonn教授是国际著名的物理化学专家, 欧洲科学院院士, 现任德国美因茨马克斯·普朗克聚合物研究所所长。Mischa Bonn也是国际公认的“分子光谱学”权威专家, 主要从事水和生物分子体系的无标记(超快)振动光谱探测与显微成像研究, 主要研究领域包括界面分子结构与动力学、界面电子转移等。Mischa Bonn于1996年获得埃因霍温大学博士学位, 随后在柏林弗里茨·哈伯研究所和纽约哥伦比亚大学从事博士后研究, 1999年受聘莱顿大学助理教授, 2002年获终身教职并晋升副教授, 2005年起担任阿姆斯特丹大学特聘教授, 2012年起兼任美因茨大学荣誉教授。Mischa Bonn曾荣获包括荷兰皇家化学会金奖和德国本生学会范特霍夫奖等多项科学奖项, 迄今已发表500余篇研究论文, 现任《化学物理杂志》副主编, 并担任《美国化学会志》等多本期刊的编委顾问委员会委员。



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