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True Surface Spectra from Sum-Frequency Vibrational Spectroscopy of Nonpolar Liquids

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时间: 12月11日 (星期四) 15:00—16:30

地点: 北京大学物理大楼中212教室

田传山, 田传山, 复旦大学物理系研究员, 分别于2001年和2006年在复旦大学获理学学士和博士学位。2002年9月—12月, 在意大利Trieste TASC-INFM同步辐射中心访问研究。2005年6月—11月, 在德国Max-Planck微结构物理研究所访问研究。2006年7月—2010年12月, 在美国加州大学伯克利分校物理系师从沈元壤教授作博士后研究。2010年12月被复旦大学作为海外优秀人才引进并聘为教授。分别于2012年和2013年获得上海市浦江人才计划和教育部“新世纪优秀人才”计划的支持。

研究兴趣包括: 表面与界面科学, 奇异材料的光学效应, 自旋电子学等。近些年主要的研究课题包括水界面科学、手性分子的光学探测与操控、自旋流成像与动力学过程等。总共发表SCI文章32篇, 著作1章。其中, 第一作者&通讯作者9篇, IF>7的6篇。文章他引约1200次。

报告摘要:

In the past decades, sum-frequency vibrational spectroscopy (SFVS) has been well established as a powerful technique for surface studies. It is based on the idea that under the electric dipole (ED) approximation, SF generation originates only from the surface or interface where the inversion symmetry is broken. There is, however, always a lingering doubt that the electric-quadrupole (EQ) bulk contribution to surface SF generation may not be negligible. The problem is particularly important for SFVS application to media that do not have a surface layer of strongly polar-oriented molecules, although it has been largely ignored by many practitioners of SFVS. Despite many theoretical and experimental studies in the past, a comprehensive picture supported by experiment is still missing.

Following our theoretical understanding, we designed an experiment and used benzene as an example to show that for the first time, we can separately obtain EQ bulk spectra and surface spectra from SFVS of a medium composed of nonpolar (symmetric) molecules. The true bulk spectra with no contribution from the surface were directly measured by transmission SFVS, and the true surface spectra with no bulk contribution was deduced from reflection SFVS through proper spectral analysis. The results also provide guidelines for evaluation of the importance of bulk contribution to SFVS when applied to media of polar molecules.

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Photograph by Xiaodong Hu