复旦大学物理系物质科学报告

Physics Department Colloquium

Ultrafast dynamics at water interfaces revealed by novel interface-selective femtosecond vibrational spectroscopy

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A molecular-level understanding of the property and dynamics of liquid interfaces is very important for various fields such as electrochemistry, colloid science, and membrane science. Vibrational sum frequency generation (VSFG) spectroscopy has inherent interface-selectivity, and it is a powerful tool to study the water interfaces. In conventional VSFG measurements, however, the intensity of the VSFG signal is detected, and hence the spectra of the absolute square of the 2nd-order nonlinear susceptibility $\left(\left|\chi^{(2)}\right|^2\right)$ are obtained. This homodyne detection has several drawbacks: The absolute square of the $\chi^{(2)}$ spectrum causes spectral deformation which makes interpretation difficult, and the information of the sign of the $\chi^{(2)}$ signal is lost. In the time-resolved (TR-) measurements, the problem becomes much more serious because the pump-induced change of the VSFG intensity $\left(\Delta\left|\chi^{(2)}\right|^2\right)$ measured in homodyne-detected TR-VSFG has no simple physical meaning. To overcome these problems, we realized multiplex heterodyne-detection of VSFG (HD-VSFG), which enables us to determine the phase and amplitude of the electronic field of the VSFG signal using the interference with the reference light. HD-VSFG enables us to obtain

$\mathrm{Im}\chi^{(2)}$ spectra, which can be directly compared to the infrared $(\mathrm{Im}\chi^{(1)})$ and Raman $(\mathrm{Im}\chi^{(3)})$ spectra in solution. Recently, we have extended HD-VSFG spectroscopy to femtosecond time-resolved measurements (TR-HD-VSFG) as well as 2D spectroscopy (2D HD-VSFG). These novel interface-selective time-resolved spectroscopy have opened a new door to study ultrafast dynamics at liquid interfaces. In this talk, we discuss our recent results obtained with TR-HD-VSFG and 2D HD-VSFG, which reveal femtosecond vibrational and chemical dynamics at water interfaces.

Time：2:00pm, Tuesday, November 29, 2016
Location：Physics Building, Room 221B
(Cookies and coffee are served from 1:30 pm)