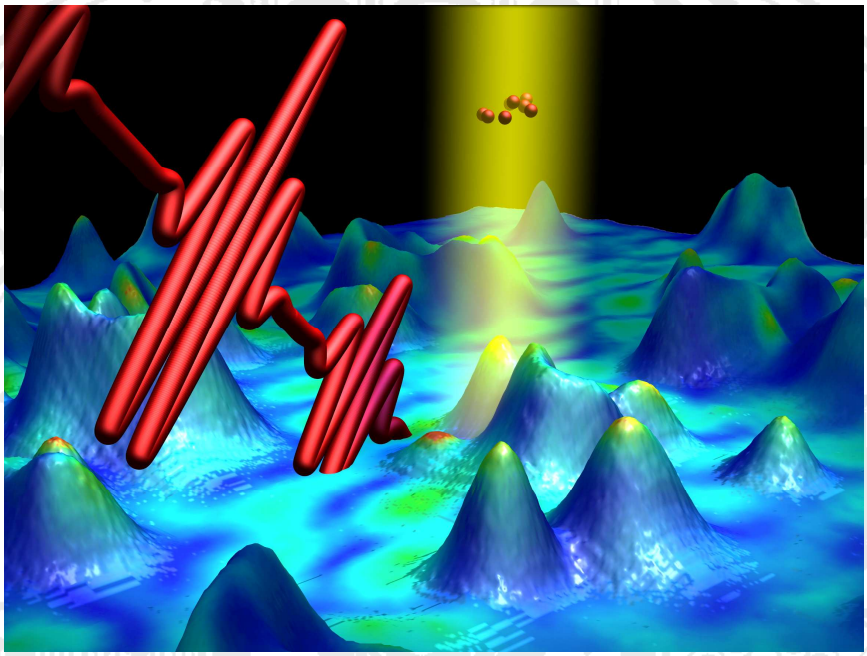
PHYSIKALISCHES KOLLOQUIUM

AM 4. JUNI 2012 UM 17 UHR C.T.

IM GROßEN HÖRSAAL



COHERENT NONLINEAR SPECTROSCOPIES WITH ULTRAHIGH SPATIAL AND TEMPORAL RESOLUTION

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Light cannot be focused to better than half its wavelength; the well-known diffraction limit thus in general prevents spatially resolved spectroscopy of individual nanostructures and their ultrafast dynamic processes. This talk will show how we can circumvent that limit and gain access to the nanometer spatial scale on a femtosecond time scale using the many degrees of freedom from coherent control concepts [Nature 446, 301 (2007); PNAS 107, 5329 (2010)]. Another approach is coherent two-dimensional (2D) spectroscopy [Nature 434, 625 (2004)] that provides detailed insight into electronic couplings and energy-transport dynamics. Recently we were able to realize 2D spectroscopy below the optical diffraction limit [see picture; Science 333, 1723 (2011)]. Unexpected long electronic phase coherences in metal nanostructures were observed and explained. Applications are envisaged and pursued for nonlinear spectroscopy of nanostructures, molecular aggregates or “artificial molecules” on surfaces, nanophotonic circuits, photovoltaic devices, coupled quantum dots, and others. It should thus become possible in the future to study a broad range of fascinating quantum phenomena with direct space–time resolution.