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Insights on strong-field ionization in non-centrosymmetric systems: from gases to solids VINCENT WANIE, INRS, TIANJIAO SHAO, University of Chinese Academy of Sciences, PHILIPPE LASSONDE, HEIDE IBRAHIM, JUDE DESCHAMPS, INRS, JIA-QI LIU, University of Chinese Academy of Sciences, FABIAN AMBRIZ VARGAS, ANDREAS RUEDIGER, FRANCOIS VIDAL, INRS, FRANCESCA CALEGARI, DESY, XUE-BIN BIAN, Wuhan Institute of Physics and Mathematics, CAS, FRANCOIS LEGARE, INRS —
Strong-field ionization of non-centrosymmetric gas molecules with femtosecond lasers typically displays preferential emission directions in molecular frame photoelectron angular distributions (MF-PADs), depending whether the permanent dipole moment is parallel or anti-parallel to the laser field. So far, there was no direct analogy of such behavior in condensed matter. Two-color laser-induced ablation of ferroelectric lithium niobate ($LiNbO_3$) was realized experimentally. Providing a macroscopic observable with large contrast, the ablated area of the material modulates by 35% when scanning the relative phase between an 1800nm field and its second harmonic. Rotating the crystal by 180 degrees around the laser propagation axis, the modulation is π-shifted, although the band structure of the material remains unchanged. Numerical simulations based on a two-band model reveal that the ionization process is sensitive to the field polarity due to the microscopic spontaneous polarization of $LiNbO_3$. Demonstrating for the first time how this fundamental property of ferroelectric materials impacts on the ionization rate, the results open new perspectives for the direct control of ionization dynamics in solids.

Vincent Wanie
INRS

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