

Phase-Resolved Attosecond Near-Threshold Photoionization of Molecular Nitrogen

Baptiste Fabre², S. Haessler¹, J. Higuet², J. Caillat³, T. Ruchon¹, P. Breger¹, B. Carré¹, E. Constant², A. Maquet³, E. Mével², P. Salières¹, R. Taïeb³ and Y. Mairesse²

¹CEA-Saclay, IRAMIS, Service des Photons, Atomes et Molécules,
91191 Gif-sur-Yvette, France

²CELIA, Université Bordeaux I, UMR 5107 (CNRS, Bordeaux 1, CEA), 351 Cours de la
Libération, 33405 Talence Cedex, France

³UPMC, Université Paris 06, CNRS, UMR 7614, LCPMR, 11 rue Pierre et Marie Curie, 75231
Paris Cedex 05, France

We photoionize nitrogen molecules with a train of extreme ultraviolet attosecond pulses together with a weak infrared field. We measure the phase of the two-color two-photon ionization transition (molecular phase) for different states of the ion. We observe a 0.9 shift for the electrons produced in the ionization channels leading to the $X^2 \Sigma_g^+$; $\nu = 1$ and $\nu = 2$ states. We relate this phase shift to the presence of a complex resonance in the continuum. By providing both a high spectral and temporal resolution, this general approach gives access to the evolution of extremely short lived states, which is hardly accessible otherwise.