Dissociation dynamics of the CO$_2$ molecule studied with XUV pump and near-infrared probe experiments$^1$ KANAKA RAJU PANDIRI, YU MALAKAR, XIANG LI, BALRAM KADERIYA, WRIGHT PEARSON, WEI CAO, ITZIK BEN-ITZHAK, DANIEL ROLLES, ARTEM RUDENKO, J.R. Macdonald Laboratory, Department of Physics, Kansas State University, KS, PHILIP TRAPP, DANIEL TRABERT, FLORIAN WILHELM, Institut fur Kernphysik, Johann Wolfgang Goethe-Universitat, Frankfurt, Germany — Ultrafast dynamics of ionic states of the CO$_2$ molecule have recently been studied by employing a pump-probe technique using broadband ultrashort XUV-pump pulses containing the 11$^{th}$ to 17$^{th}$ harmonics of a near-infrared laser (NIR) [1]. Here, we present the results of a complimentary experiment employing longer (~100 fs) but narrowband, single harmonic (11$^{th}$ or 13$^{th}$) pulses to excite molecular wave packets to specific states of CO$_2^+$, which are probed by NIR-induced dissociation. We employ a reaction microscope to measure energy- and angle-resolved yields of all charged reaction fragments as a function of XUV-NIR delay. In particular, the delay dependence of O$^+$ and CO$^+$ ion production for parallel and perpendicular NIR and XUV polarizations are contrasted with the data obtained by Timmers et al. [1] using ultrashort broadband train of harmonics. [1] H. Timmers et al., Phys. Rev. Lett. 113, 113003 (2004).

$^1$This project is supported by the Chemical Sciences, Geosciences, and Biosciences Division, Office of Basic Energy Sciences, Office of Science, U. S. Department of Energy. K. R. P. and W. L. P. are supported by National Foundation Award No. IIA-143049.

Kanaka Raju Pandiri
J.R. Macdonald Laboratory, Department of Physics, Kansas State University, KS

Date submitted: 29 Jan 2016

Electronic form version 1.4