

Time diffraction at optical frequencies

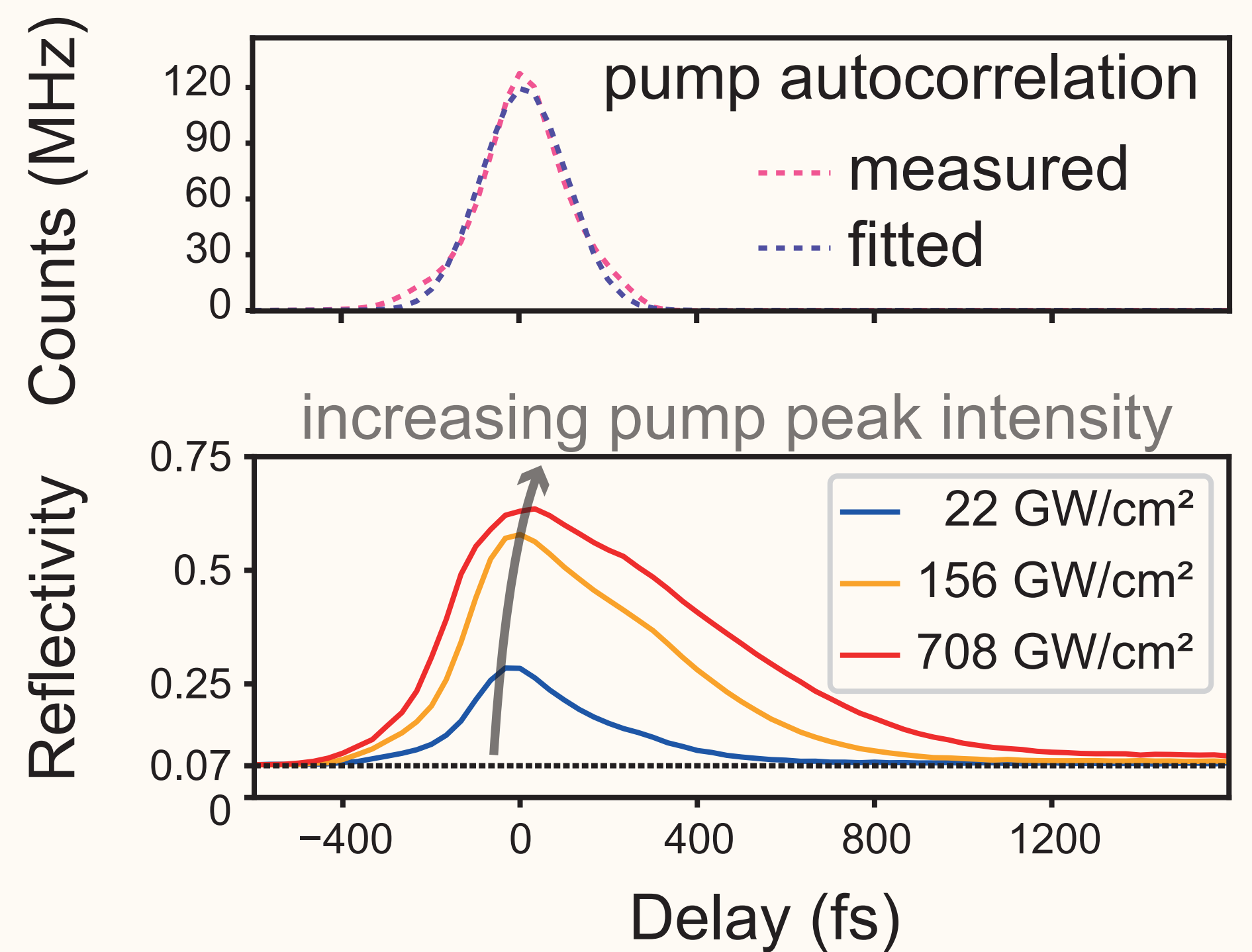
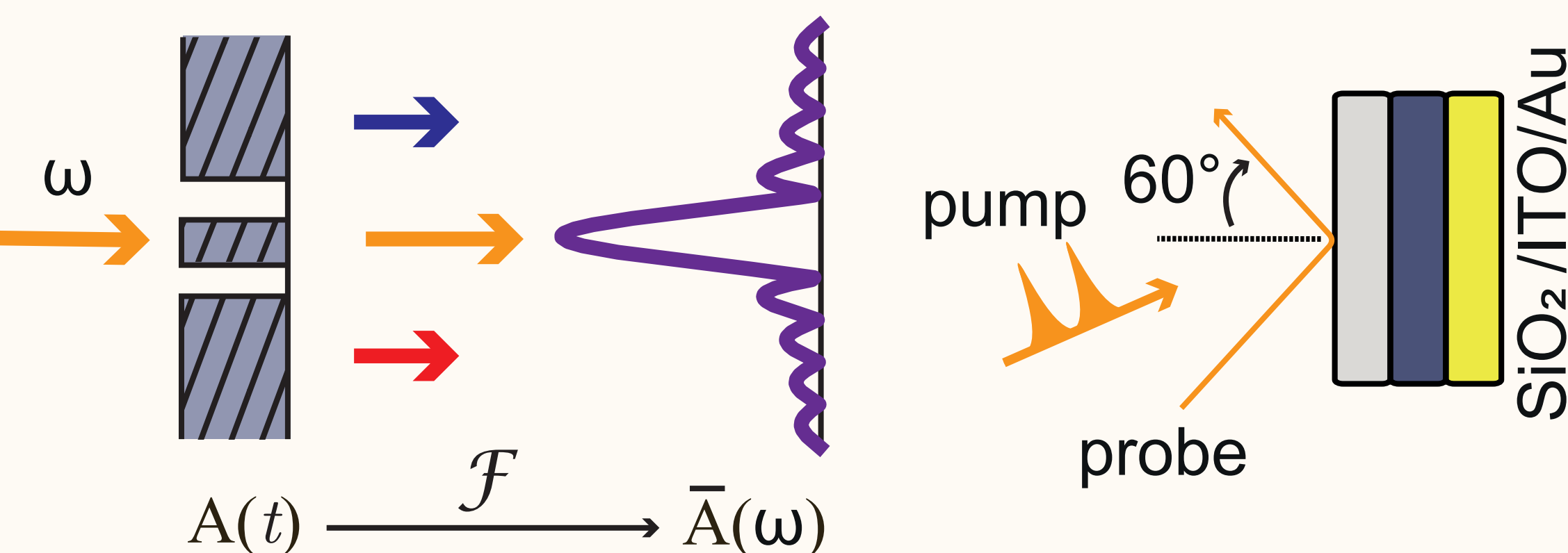
Romain Tirole^{1*}, Stefano Vezzoli^{1*}, Emanuele Galiffi², Dries Maurice¹, Iain Robertson¹, Jakub Dranczewski¹, Benjamin Tilmann³, Yao-Ting Wang², Andrea Alù^{2,4}, Paloma Arroyo-Huidobro⁵, Stefan Maier^{1,3,6}, John B. Pendry¹, Riccardo Sapienza¹

¹ The Blackett Laboratory, Department of Physics, Imperial College London; London SW7 2BW, United Kingdom
² Photonics Initiative, Advanced Science Research Center, City University of New York; 85 St. Nicholas Terrace, 10031, New York, NY, USA
³ Chair in Hybrid Nanosystems, Nanoinstitut München, Ludwig-Maximilians-Universität München; 80539 München, Germany
⁴ Physics Program, Graduate Center, City University of New York, New York, NY 10016, USA
⁵ Instituto de Telecomunicações, Instituto Superior Técnico-University of Lisbon, Avenida Rovisco Pais 1, Lisboa, 1049-001 Portugal
⁶ School of Physics and Astronomy, Monash University; Clayton Victoria 3800, Australia

Young's experiment in time

- Platform: 40 nm Indium-Tin-Oxide on Au driven by 225 fs pump pulse

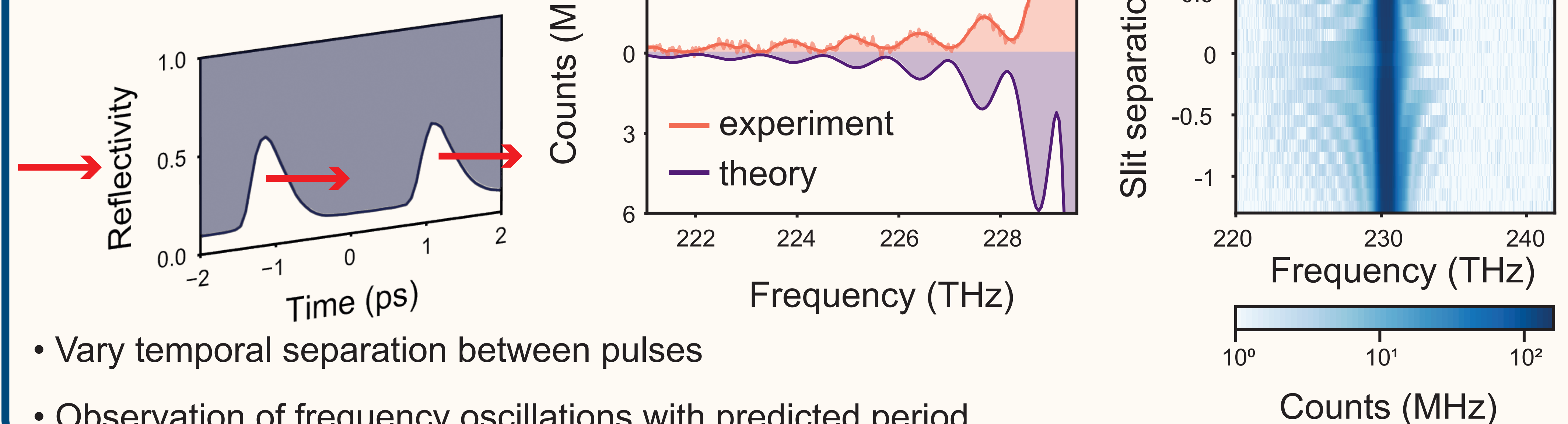
- Reflectivity = aperture is driven by nonlinearities



- Reflectivity follows the intensity of the pump pulses in time → ultrafast change

Double slit diffraction

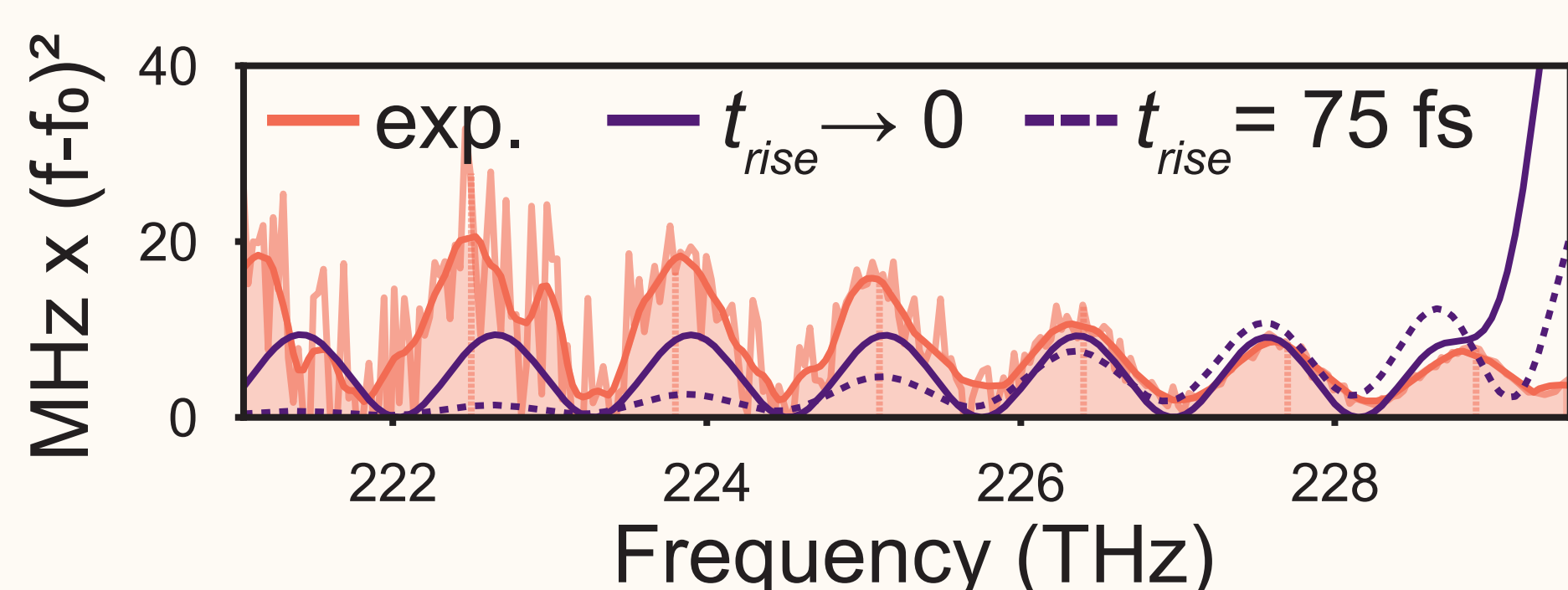
Probe: 800 fs, 230 THz



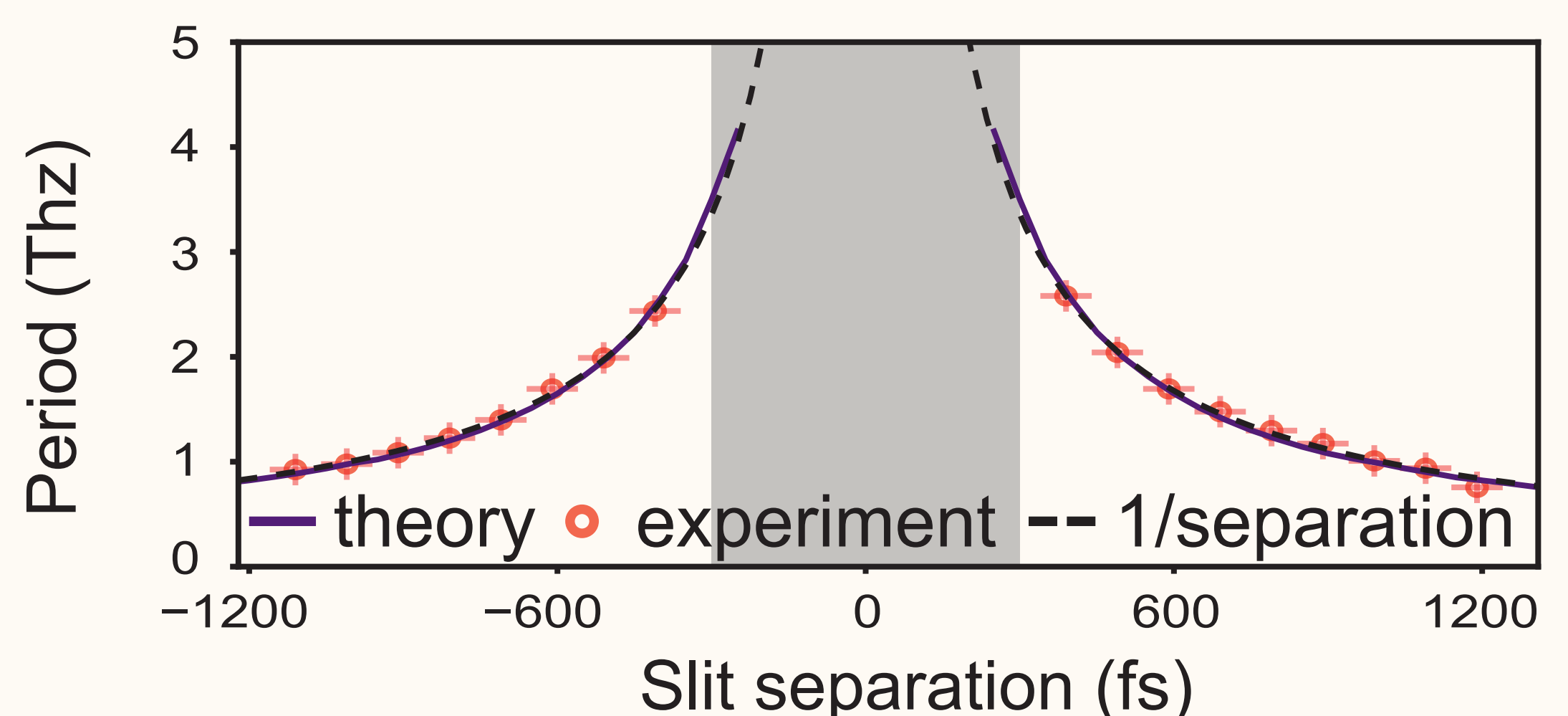
- Vary temporal separation between pulses
- Observation of frequency oscillations with predicted period

ITO response time

Near the asymptotic limit where $t_{rise} \rightarrow 0$
 Also seen in single-slit measurements!



Spectral period



Tirole et al. (2022) Saturable time-varying mirror based on an ENZ material, ArXiv
 Tirole et al. (2022) Double-slit time diffraction at optical frequencies, ArXiv

Imperial College
London

LMU
LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

UKRI

Engineering and
Physical Sciences
Research Council

scan for more details

