

Symposium 25 Years of Recollision Physics (SYRP)

jointly organized by
the Atomic Physics Division (A) and
the Molecular Physics Division (MO)

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25 years ago, a novel physical picture emerged that allowed a unified interpretation of several phenomena like above threshold ionization (ATI) and high harmonic generation (HHG), by breaking down the laser-atom interaction into three distinct steps: ionization, propagation and recollision. This intuitive picture has since then formed the basis for a number of revolutionary developments, most prominent of all the emergence of attosecond science. The purpose of this symposium is to celebrate the recollision model that emerged twenty five years ago, and to highlight many of the important developments in recollision physics that have occurred since then.

Overview of Invited Talks and Sessions

(Lecture room RW HS)

Invited Talks

SYRP 1.1	Fri	10:30–11:00	RW HS	Attosecond seeding of high energy rescattered electrons — ●KENNETH SCHAFFER
SYRP 1.2	Fri	11:00–11:30	RW HS	The molecular selfie - atomic-scale imaging with a single electron — BENJAMIN WOLTER, MICHAEL G. PULLEN, ANH THU LEE, MATTHIAS BAUDISCH, KATHARINA DOBLHOFF-DIER, ARNE SENFTLEBEN, MICHAEL HEMMER, CLAUS DIETER SCHRÖTER, JOACHIM ULLRICH, ROBERT MOSHAMMER, STEFANIE GRÄFE, ORIOL VENDRELL, CHII DONG LIN, ●JENS BIEGERT
SYRP 1.3	Fri	11:30–12:00	RW HS	Multidimensional attosecond spectroscopy — ●NIRIT DUDOVICH
SYRP 1.4	Fri	12:00–12:30	RW HS	Recollision-based high-harmonic generation from solids — ●GIULIO VAMPA

Sessions

SYRP 1.1–1.4	Fri	10:30–12:30	RW HS	Symposium 25 Years of Recollision Physics
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SYRP 1: Symposium 25 Years of Recollision Physics

Time: Friday 10:30–12:30

Location: RW HS

Invited Talk

SYRP 1.1 Fri 10:30 RW HS

Attosecond seeding of high energy rescattered electrons — ●KENNETH SCHAFER — Department of Physics and Astronomy, Louisiana State University, Baton Rouge, LA 70803 USA

Twenty five years ago, advances in both theory and experiment transformed strong field physics from a collection of interesting phenomena – notably above threshold ionization and high harmonic generation – into one of the most vibrant and relevant subfields of physics today. In this talk I will discuss work over the past decade to use attosecond pulses, the primary outgrowth of recollision physics, to study strong field processes themselves. In particular, we study the production of high energy photoelectrons via strong field-driven recollision when the tunnel ionization step is replaced by an attosecond pulse train. This allows insight into the rescattering of electron wave packets formed both near the laser field maxima, the normal tunnel ionization condition, and also near the laser field minima, something that does not occur via tunnel ionization.

Invited Talk

SYRP 1.2 Fri 11:00 RW HS

The molecular selfie - atomic-scale imaging with a single electron — BENJAMIN WOLTER¹, MICHAEL G. PULLEN¹, ANH THU LEE², MATTHIAS BAUDISCH¹, KATHARINA DOBLHOFF-DIER³, ARNE SENFTLEBEN⁴, MICHAEL HEMMER^{1,5}, CLAUDIUS DIETER SCHRÖTER⁶, JOACHIM ULLRICH^{6,7}, ROBERT MOSHAMMER⁶, STEFANIE GRÄFE^{8,9}, ORIOL VENDRELL^{5,10}, CHI DONG LIN², and ●JENS BIEGERT^{1,11} — ¹ICFO-Institut de Ciències Fòtoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels, Barcelona, Spain — ²J. R. Kansas State University, Manhattan, KS 66506-2604, USA — ³Leiden Institute of Chemistry, Leiden University, Post Office Box 9502, 2300 RA Leiden, Netherlands — ⁴Universität Kassel, Heinrich-Plett-Str. 40, 34132 Kassel, Germany — ⁵Center for Free-Electron Laser Science, 22607 Hamburg, Germany — ⁶Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany — ⁷Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, 38116 Braunschweig, Germany — ⁸Institute for Physical Chemistry, Friedrich-Schiller University Jena, 07743 Jena, Germany — ⁹Abbe Center of Photonics, Friedrich-Schiller-University Jena, 07743 Jena, Germany — ¹⁰Department of Physics and Astronomy, Aarhus

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We used laser-induced electron diffraction to image bond scission in real time and real space with 0.6 fs temporal and 6 pm spatial resolution.

Invited Talk

SYRP 1.3 Fri 11:30 RW HS

Multidimensional attosecond spectroscopy — ●NIRIT DUDOVICH — Weizmann Institute of Science

Attosecond science is a young field of research that has rapidly evolved over the past decade. Performing time-resolved measurements with attosecond precision is a significant challenge. Currently, two main approaches have been successfully demonstrated. The first approach, Attosecond Pump-Probe Spectroscopy, applies an attosecond pulse to initiate or probe a fast-evolving process. An alternative approach, Attosecond Self-Imaging, applies the attosecond production process, to perform the measurement. In the talk I will describe a new measurement scheme in which we integrate the two main branches in attosecond spectroscopy. In this scheme extreme ultraviolet attosecond pulses initiate an electron wavepacket by photo-ionization, a strong infrared field controls its motion, and finally electron-ion collision maps it into re-emission of attosecond radiation bursts. Our measurements resolve the internal clock provided by the self-probing mechanism, probing the photoionization the build-up of photo-ionization in the presence of the strong laser field.

Invited Talk

SYRP 1.4 Fri 12:00 RW HS

Recollision-based high-harmonic generation from solids — ●GIULIO VAMPA — Stanford PULSE Institute, SLAC National Accelerator Laboratory, Menlo Park, CA 94025, USA

I will present how strongly-driven electrons and holes in crystals can lead to high-harmonic emission upon their recollision. The spatial periodicity and the non-trivial energy structure of solids adds a twist to the well-established recollision physics in the gas-phase, adding new phenomena and capabilities - some of which will be highlighted in the talk.