

Probing Molecular Dynamics in Real Time

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The knowledge of the earliest time dynamics in molecular photophysics and photochemistry are critical because their role is to harness the energy from photons, initiating electronic and nuclear motion, which is fundamental in many areas of science. Our ultimate goal is to understand the coupled electronic and nuclear dynamics induced by the absorption of photons by molecules, which leads first to attosecond electron excitation within the molecules, followed by nuclear motion in the femtosecond range. This eventually results in the breaking and making of chemical bonds on the picosecond timescale.

The past decade has seen the exciting birth of the first X-ray laser, the LCLS free electron laser (FEL) followed by other FELs around the world, leading to an explosion of new science, in the femtosecond and very recently in the attosecond timescale regime. Recent time-resolved experimental results will be presented using pump-probe technique with FELs to watch, in real time, the response of large molecules to intense X-rays as well as to examine the role of physical and chemical effects and how they lead to bonds breaking. Table-top laser experiments on H- migration in molecules will be presented if time permits.

BIOGRAPHICAL SUMMARY

Nora Berrah is a Professor at the Physics Department at the University of Connecticut since 2014 and she served as its Head between 2014-2018. Her research interests are in experimental Atomic, Molecular and Optical Physics. She received her PhD from the University of Virginia in 1987, was a postdoctoral fellow (87-89) and an Assistant Physicist (89-91) at the Physics Division at Argonne National Laboratory before becoming an assistant professor at Western Michigan University (91). She became a Distinguished Faculty Scholar in 2000. Berrah was a visiting scholar at the Université d'Orsay, Paris, France, at the Fritz-Haber-Institute der Max Planck Gesellschaft, Berlin, Germany, at the Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory (LBNL), at the PULSE Ultrafast Center, Stanford Linear Accelerator Center (SLAC), and at the Université Pierre et Marie Curie, Paris VI, France. She received the David. S. Shirley Award for "Outstanding Scientific Achievements" at the ALS, LBNL, a Humboldt Fellowship award from the Alexander von Humboldt Foundation, Germany, and the 2011 Chair d'Excellence from SOLEIL National Synchrotron Laboratory, France. She recently received the 2019-2022 Blaise Pascal Chair d'Excellence from the Commissariat à l'Energie Atomique (CEA, Paris, Saclay), France. She received the Honorary Doctoral Degree in Physics from the University of Turku, Finland, September 2021. Berrah is an APS and AAAS Fellow and the recipient of the 2014 APS Davisson-Germer award. She is a member of American Academy of Arts and Sciences (2019).

Berrah serves on the 2023 APS task force, served as the Chair of APS Nominating Committee, on the APS Board of Directors, on the APS council, the American Academy of Arts and Sciences, the American Institute of Physics Investment Advisory Committee, the AAAS Council Delegate in the Physics Section, the APS Nominating Committee, the APS Division of Atomic, Molecular and Optical Physics (DAMOP) Nominating Committee, the Committee of the Status of Women in Physics, the DAMOP Executive Committee (twice), The Davisson-Germer Award Committee, the I. I. Rabi Prize Committee, the APS Committee on International Scientific Affairs, the Executive Committee Division of Laser Science, the National Research Council (CAMOS), the Executive Committee of the Division of Laser Science, the Executive Committee of the APS Topical Group on Few-Body Physics, the Forum on International Physics, and she serves on various review committees for NSF and DoE Office of Science. She also served on National Science Advisory Committees or National Facilities Users Committees of ALS/LBNL, SSRL/SLAC, LCLS/SLAC. She serves on European Union Networks for Research and Innovations, on several International Review Committees, National and International conference Program Committees and she co-chaired the International Conference on Photonic, Electronic and Atomic Collisions, ICPEAC XXVI, 2009.

Berrah's research career focuses on the study of the interaction of atoms, molecules and clusters with weak and strong electromagnetic fields produced by various light sources. Her recent research interests are in the areas of non-linear physics, quantum control and time resolved studies of molecules including long and short wavelength radiation, ultrafast time scales and strong laser fields. Her current research involves the use of intense femtosecond and attosecond pulses from HHG sources and free electron lasers (FELs) in the VUV, XUV and X-ray regimes.