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Earle K. Plyler Award: X-Ray and UV Studies of Molecular and Nano-Systems at the Atomic-Scale Resolutions of Time and Space

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The advent of femtosecond (fs) laser technology some twenty five years ago opened a whole new era in Science because of its ability to probe in “real-time” nuclear motion in molecules, crystals, liquids and proteins. In the past fifteen years, huge efforts have been deployed aimed at combing the high time resolution of fs lasers with the high spatial resolutions of structural techniques, such as X-ray spectroscopies. In addition, lab-based sources of ultrashort vacuum ultraviolet and soft X-rays based on the process of High Harmonic Generation have made it possible to study the underlying electronic structure changes which drive the actual structural dynamics of systems. In the optical domain, huge efforts have been deployed in extending the availability of sources to the UV below 300 nm, which is very important for the study of small molecules, amino-acid residues, nucleotides or metal oxides as they all absorb in this region. We will present some of our recent studies using ultrafast X-ray absorption spectroscopy and 2-dimensional UV spectroscopy for the study of molecular systems and nanoparticles. I will also discuss the perspectives these methods offer for materials science, chemistry and biology.