Ultrafast laser pulses are considered photonic reagents that can be used to study and control chemistry by our group. We are engaged in developing the laser technology as well as the novel applications that become available in areas such as biomedical imaging, molecular detection and identification and proteomic analysis. Our group has six state-of-the-art femtosecond laser systems with MIIPS pulse shaping technology available for our projects.

Some of our challenging projects include:

- Development of multidimensional spectroscopic methods for standoff identification of chemicals in solid, liquid and gaseous states;
- Exploring novel biomedical applications of nonlinear photonic control for selective two-photon microscopy and imaging through tissue;
- Exploring the behavior of molecules under intense laser fields;
- Development of fiber laser technology coupled to automated phase optimization for biomedical applications;
- Development of femtosecond laser induced dissociation for proteomic and metabolomic analysis.

Ultrafast Lasers and Imaging. The laser pulses in our laboratory are short enough to “freeze” the motion of atoms and allow us to see chemical reactions as they take place. Using a pulse shaper, we are able to tailor the phase of the individual wavelength components. These shaped pulses can be used to control the quantum-mechanical aspects of laser-molecule interactions. For example, we can control which molecules absorb energy and which do not, an aspect we have used to achieve selective two-photon microscopy.

Our group has a number of inter-disciplinary interests (Physics, Chemistry, Biology, Medicine, and Engineering) that lead to collaborations with other universities, agencies, and companies. The teamwork we practice leads to a high level of productivity, shared responsibility and success. You can expect to be involved in the preparation of several manuscripts. The creativity and forward-thinking that we encourage has led to 7 issued patents and 29 patent applications. We are constantly involved in the preparation of several manuscripts. The creativity and forward-thinking that we encourage has led to 7 issued patents and 29 patent applications. We are constantly involved in the preparation of several manuscripts. The creativity and forward-thinking that we encourage has led to 7 issued patents and 29 patent applications. We are constantly involved in the preparation of several manuscripts. The creativity and forward-thinking that we encourage has led to 7 issued patents and 29 patent applications. We are constantly involved in the preparation of several manuscripts.