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NMR provides unparalleled information regarding chemical identification and molecular structure. Our work focuses on the development and application of new NMR methods that deliver higher sensitivity and throughput for a range of applications.

Recent advances in drug discovery processes have made the development of high throughput NMR analysis desirable. We are developing a new methodology, Multiplex NMR, in which multiple, miniaturized sample coils are used to excite and detect the NMR signals from different sample volumes in parallel. This approach has the potential to increase the throughput of NMR measurements for applications such as the analysis of large molecular libraries, and for parallel process monitoring.

MultiplexNMR probeNew laser-based methods (optical pumping) have been shown to create enormous enhancements (105 or more) in the NMR signal of xenon, which can be used to enhance the surface signal. Optical pumping extends NMR surface studies to a wide variety of novel materials, including semiconductor nanoparticles, diamond films, and advanced catalysts.

We are also interested in the study of environmental surfaces. Photocatalytic materials have promise for the efficient degradation of environmentally toxic compounds. We have synthesized and investigated various photocatalysts to understand the surface chemistry at a fundamental level, and to improve their performance.