

# Nuclear Magnetic Resonance (NMR) Spectroscopy

## Methodology

- Toroid-cavity NMR detector and probe development
- Patented CapPack™ devices for quantitative NMR pulse, hardware and software performance evaluation
- Computational methods for high-resolution NMR relaxometry
- Solvent-signal suppression for applications in life science and chemical synthesis
- Monitoring the fate of  $x$ ,  $y$ , and  $z$  magnetization during pulse sequences as tool for NMR experiment development

## Applications

- Acupuncture Magnetic Resonance Imaging (MRI) for minimally invasive skin cancer and melanoma detection
- High-pressure and temperature in situ NMR investigations under industrially relevant reaction conditions (100 atm & 100 °C)
- Hydrothermal conversion of cellulosic biomass to liquid fuel precursor materials
- Fluid properties of organic material in oil and gas shale

## Building our own high-resolution NMR probes and devices



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## Keywords

- In situ NMR Spectroscopy; targeted drug delivery; early cancer detection; academic transformation; chemical education

## Recognitions

- President's Award for Innovative Teaching, University of Missouri System
- Salute to Excellence Award for "Continued Contribution to the American Chemical Society"
- R&D 100 Award "Toroid Cavity Imager"