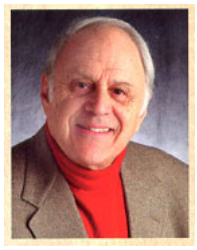
Pulsed NMR and NMR Imaging

Buffalo State College, July 9–12, 2017.

One or Two set-ups available

Host and Mentor



Jonathan F. Reichert is Emeritus Professor of Physics at SUNY at Buffalo; President and founder of Teachspin, Inc.; and co-founder of the Advanced Laboratory Physics Association. His first experience with magnetic resonance experiments came in the 1950's during his graduate study at Washington University, when this was a new tool for physicists. Most of his forty year research career was spent doing some type of magnetic resonance experiments. At both CWRU and SUNY Buffalo, he developed and taught the advanced laboratory course. He shared in the design and construction of both PS1-A, B and PS2-A, TeachSpin's pulsed NMR apparatus. Participants in the immersion will be using PS2-B, shown above, TeachSpin's newest NMR spectrometer.

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This Immersion takes instructors through the basic concepts and measurements of Pulsed Nuclear Magnetic Resonance, including effective fields in the rotating coordinates, precession, spin-flips, relaxation processes, spin-echoes, and Fourier transform spectroscopy, with the goal of performing and understanding NMR Imaging. The Bloch Equations will form the theoretical basis for exploring Pulsed NMR.

Pulsed NMR remains one of the most important experimental tools for physicists because it provides a unique non-invasive probe to study both the internal structure and motions of solids and liquids with magnetic nuclei. Instruments capable of these measurements are now affordable on an advanced laboratory budget.

The session will begin by tuning the spectrometer to perform single-pulse experiments in both liquids and soft solids. Then it will progress to measure both the spin-spin (T_2) and spin-lattice (T_1) relaxation times in these materials. We will retune the spectrometer to observe the single pulse experiments in fluorine liquids using FFT spectroscopy. Finally, exploiting the use of deliberate magnetic-field gradients, participants will study 1-dimensional imaging in layered soft-solid samples using FFT spectroscopy.

Participants should bring their own scientific calculators and some sort of data book. The cost for the TeachSpin PNMR apparatus is about $18K, and requires an ordinary digital oscilloscope for readout.

Please note that the Jonathan F. Reichert Foundation has established a grant program (ALPhA webpage; Foundation website) to help purchase apparatus used in Laboratory Immersions. Limitations and exclusions apply, but generally speaking the foundation may support up to 40% of the cost of the required equipment.
