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Free-electron laser-based pulsed electron paramagnetic resonance
SUSUMU TAKAHASHI, MARK S. SHERWIN, GERALD RAMIAN, University of California Santa Barbara, LOUIS-CLAUDE BRUNEL, JOHAN VAN TOL, National High Magnetic Field Laboratory — High-power pulsed electron paramagnetic resonance (EPR) is extremely useful to study the ultrafast dynamics of spins. At present, most high-power pulsed EPR spectrometers operate near the X-band frequency of 9.5 GHz with kW-level power. A trend in the evolution of next generation pulsed EPR is for higher magnetic field and frequency, both for finer spectral and time resolution and because motional averaging becomes negligible. Since the linewidth of resonances studied by pulsed EPR tends to be extremely narrow, the source radiation also has to be stable and have narrow bandwidth. High-power pulsed EPR, using few-ns pulses to rapidly manipulate spins for spin-echo and related experiments, has been demonstrated at 95 GHz using kW- power Klystron-based sources. A bottleneck for higher frequency pulsed EPR spectroscopy is a lack of sources with high power and narrow bandwidth. The University of California Santa Barbara (UCSB) free-electron lasers (FEL) are potential sources for high-power pulsed EPR because they generate kW of power tunable from 120 GHz to 4.7 THz. We present the current status of the UCSB FEL-based 240 GHz pulsed EPR spectrometer.

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