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Dynamic Nuclear Polarization with Solid-State mm-Waves, 3D-Printed Components, and SDR-based NMR

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A new dynamic nuclear polarization (DNP) target system has recently come on-line at the University of New Hampshire. DNP is driven by a novel solid-state 140 GHz mm-wave source with quasi-optics transmission and low-loss (<0.1 dB/m) overmodal waveguide that is insensitive to magnetic fields. We have also developed a method to 3D print with Kel-F, which was used to produce target material cups and is being used to study quasi-optical properties of Kel-F lenses. Other off-the-shelf 3D printed materials have been found to survive multiple 1 K temperature cycling and are utilized in target stick construction. Polarization measurements are made and cross-compared on a Liverpool Q-meter, LANL Q-meter, and low-cost software-defined-radio based vector network analyzer. An overview of this system and current progress will be presented.

Summary

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