A new method for understanding dynamic nuclear polarization

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Funding Grants: S. Jannin (ERC 714519, MSC 766402); G. Boebinger (NSF/DMR 1644779); T. Cross (NIH S10 OD018519, NIH P41 GM12269801)

Dynamic nuclear polarization (DNP) is a technique that boosts the sensitivity of *nuclear magnetic resonance* (NMR) and *magnetic resonance imaging* (MRI) by orders of magnitude, enabling an ever-growing number of new applications. DNP uses microwave irradiation to transfer the electron spin polarization from polarizing agents to nearby nuclear spins. A crucial step in DNP is the spontaneous transfer of spin polarization from nuclear spins that are close to polarizing agents to nuclear spins that are further away (**core** and **bulk** spins, respectively). This mechanism is poorly understood.

MagLab users have introduced a simple method to monitor the polarization transfers, called *hyperpolarization resurgence* (**HypRes**). HypRes consists of creating a strong gradient of polarization between the core and bulk spins and observing the equilibration between them, which requires the ability to rapidly switch on and off the microwaves irradiating the sample that drive the DNP process. The MagLab has unique instrumentation that realizes these experimental conditions.

HypRes will permit testing the effects of various experimental parameters on polarization transfers, including polarizing agent structure, spin density, temperature, sample spinning, and sample composition. HypRes will thus provide needed experimental data to develop better theoretical models for describing polarization transfers.

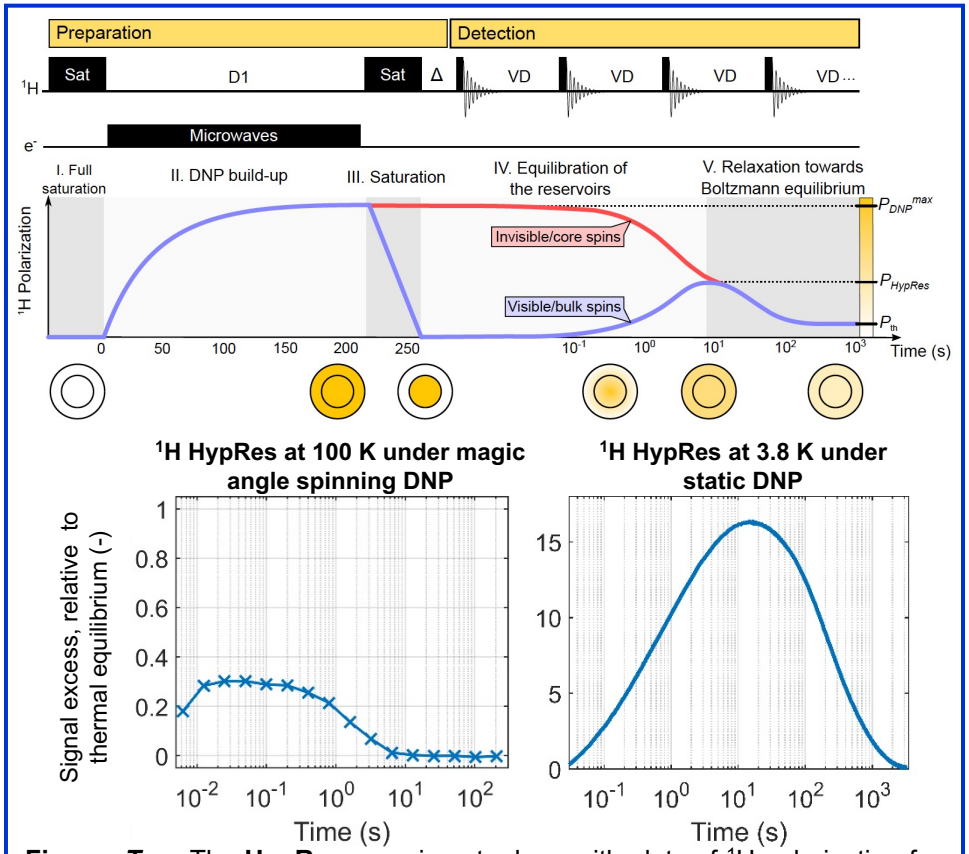

Figure: ***Top***: The **HypRes** experiment, along with plots of ^{1}H polarization for bulk (blue) and core (red) spins. ***Bottom***: Experimental demonstration of HypRes under magic angle spinning (left) and static (right) conditions showing delayed transfer of spin polarization from the core to the bulk. Microwave gating on the 600 MHz DNP platform at the MagLab was crucial for this experiment. (see citation below)

Facilities used: NMR/MRI, 600 MHz DNP MAS NMR

Citation: Stern, Q.; Cousin, S.; Mentink-Vigier, F.; Pinon, A.; Elliott, S.; Cala, O.; Jannin, S., *Direct observation of hyperpolarization breaking through the spin diffusion barrier,* Science Advances, **7**, eabf5735 (2021) doi.org/10.1126/sciadv.abf5735