

## Invitation to IQ<sup>ST</sup> Seminar

on **Wednesday**, July 3<sup>rd</sup>, 2019, 3pm  
Seminar Room of the Institute of Smart Sensors, PWR47 V47 3.149  
Universität Stuttgart



Prof. Dr. Thomas Theis,  
Assistant Professor  
North Carolina State University, Department of Chemistry

### **Hyperpolarization Chemistry and Spin Physics for Next-Generation Biosensing**

Magnetic resonance is an indispensable tool for diverse science, ranging from the most fundamental spin physics and chemistry, probed by NMR spectroscopy, to everyday clinical imaging performed by MRI. However, magnetic resonance signals and the required nuclear spin polarization remain weak even in magnetic fields of superconducting magnets. Only about 1 in 100,000 spins aligns with the magnetic field. Accordingly, NMR and MRI are cherished for their molecular specificity and contrast rich images, but suffer from very low sensitivity. To overcome this limitation, we develop hyperpolarization chemistry using para-hydrogen as the quantum mechanical source of spin order to align much larger fractions of spins. NMR and MRI signals are enhanced by up to six orders of magnitude breaking current sensitivity limits. Fundamental spin physics, chemical design and engineering efforts are combined to make hyperpolarization chemistry ubiquitously practical. Specifically, our efforts are geared towards portable NMR devices for metabolic screening, elucidation of biostructures and dynamics at physiological concentrations, as well as in vivo molecular imaging of metabolic pathways.

Host: Prof. Dr. Jens Anders, Institute of Smart Sensors, Universität Stuttgart