Pushing the Limits of Electron Paramagnetic Resonance
A. Schnegg

Berlin Joint EPR Lab, Institute for Nanospectroscopy, HZB, Berlin, Germany

The employment and further development of Electron paramagnetic resonance (EPR) lead to recent breakthroughs in such dissimilar disciplines as structural biology, organic and inorganic chemistry and catalysis, as well as functional and magnetic materials research. However, the further exploitation of conventional EPR techniques is limited by several major challenges. First the detection sensitivity is oftentimes not sufficient for studies in small spin quantities in highly diluted samples or thin films. To push this limit we recently developed high field and spatially resolved electrically detected magnetic resonance/imaging for the sensitive detection, assignment and spatial mapping of spin dependent transport processes in semiconductor devices. Herein, I will report on recent applications of combined high field and spatially resolved EDMR for studies in spin transport and loss mechanisms in thin film amorphous silicon solar cells. A second major challenge are internal magnetic fields, which may render high spin systems (\(S > \frac{1}{2}\)) “EPR silent” at conventional EPR detection frequencies. This urges for the employment of broad band very high frequency/ high field EPR approaches. An ideal strategy for the detection of high spin states exhibiting very large zero field splittings is provided by synchrotron based broadband THz-EPR, as will be demonstrated for transition metal ion based single molecule magnets.