Prediction of NMR Gyroscope Performance using Numerical Modelling

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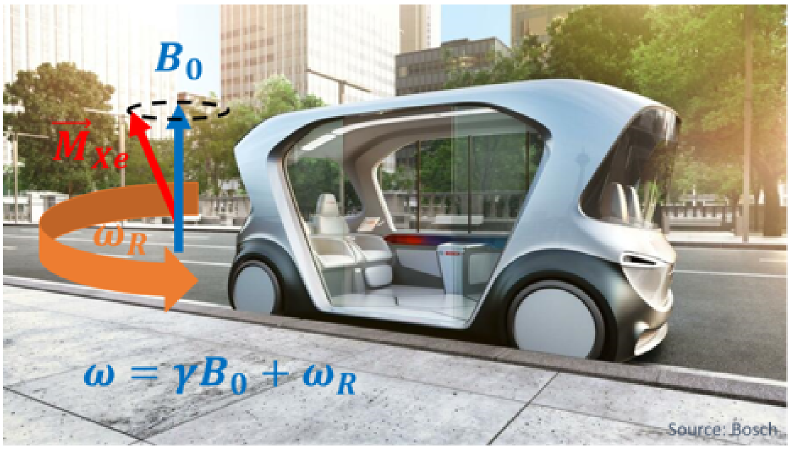
Combining the high sensitivity of alkali vapor magnetometers with noble gases, using spin exchange optical pumping, results in a high sensitivity to non-magnetic spin interaction, such as rotation. In 2016 T.G. Walker et. al [1] presented a first miniaturized gyroscope based on two Xenon isotopes and Rubidium with navigation grade performance. Together with the high potential of miniaturization, this technology can become a key-enabler for many future applications e.g. autonomous driving/flying, aeronautics, space and shipping.



We present our work towards a miniaturized Nuclear Magnetic Resonance (NMR) Gyroscope, based on Rubidium and Xenon confined in a MEMS vapor cell. Modelling of the entire system, based on numerical solution of the Optical Bloch Equations, allows a precise study of the system behavior. This is used for parameter studies beyond the analytical solution and optimization of critical sensor and closed-loop-electronic parameters.

References

[1] T. G. Walker, M. S. Larsen, Advances in Atomic, Molecular and Optical Physics, Academic Press **65**, 373-401 (2016).