Stuttgarter Physikalisches Kolloquium

Max-Planck-Institut für Festkörperforschung
Max-Planck-Institut für Intelligente Systeme
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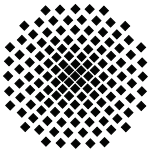

Dienstag, 18. November 2014 | **17.15 Uhr** | **Hörsaal 2 D5**

Stuttgarter Max-Planck-Institute, Heisenbergstraße 1, 70569 Stuttgart-Büsnau

Spin Mechatronics
Mechanical Generation of Spin and Spin Current

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Abstract

A. Einstein and W.J. de Haas discovered experimentally the equivalence of magnetic moment and mechanical rotation in 1915 [1]. In the same year, S.J. Bernett showed that the mechanical rotation can generate a magnetic field, i.e., the so-called Bernett field, even in a body with no electric charge [2].
These phenomena are caused by the angular momentum conservation between electron spin and mechanical rotation, which has been proved in the general relativistic quantum mechanics [3].
We introduce mechanical effects in spintronics and propose a variety of novel spintronics phenomena. In particular, the coupling between nuclear spin and mechanical rotation is demonstrated [4]. Since the Bernett field is enhanced more than three orders of magnitudes in nuclei than electron spins, the mechanical nuclear-magnetic-resonance (NMR) may provide new applications of NMR.
We also observe the generation of spin current by the flow of liquid metals. Combining this effect with the spin Hall effect [5], the spin-hydrodynamic generation of electricity is obtained [6].
The mechanical generation of spin and spin current opens a door from “Spintronics” to "Spin-Mechatronics".

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[2] S.J. Bernett, Phys. Rev. **6**, 239 (1915).
[3] M. Matuo, J. Ieda and S. Maekawa, Phys. Rev. Lett. **106**, 076601 (2011).
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[5] Spin Current, eds. S. Maekawa *et al*. (Oxford University Press, 2012).
[6] R. Takahashi, M. Ono, K. Harii, S. Okayasu, M. Matsuo, J. Ieda, S. Takahashi, S. Maekawa and E. Saitoh, (to be published).