Heat-assisted magnetic recording – recent progress and future perspectives of micromagnetic modeling

Christoph Vogler[1], Dieter Suess[1]

[1]Faculty of Physics, University of Vienna, Austria

Heat-assisted magnetic recording (HAMR) is widely regarded as most promising future storage technology to achieve areal storage densities of 5 Tb/in² and beyond. Accurately modeling the magnetization dynamics during HAMR is computationally demanding, because fast varying temperatures, in the vicinity of the Curie temperature of the underlying recording media, must be considered. For this purpose we developed a coarse grained model based on the Landau-Lifshitz-Bloch equation [1], which is both fast and accurate. In this talk we will shortly review this coarse grained model. Further, we present which progress has been made in the near past concerning micromagnetic modeling and simulation of HAMR. In particular, we will focus on a semi-analytical model [2], which allows deep insights into the basic mechanisms of magnetic noise, restricting the areal storage density.

Moreover, we show how the transition curvature of bits in granular media can be reduced during HAMR (see Figure 1) by simply reversing the inductive write element of a state-of-the-art HAMR write head [3]. Without heat-assist there does not exist any known possibility to straighten the curvature of written bit transition.

Additionally, we want to illustrate the perspectives of advanced exchange-coupled recording media with an FeRh interlayer. If the medium is clever designed this interlayer, showing a phase transition from an antiferromagnetic phase at room temperature to a ferromagnetic phase at high temperatures, can significantly reduce magnetic noise.

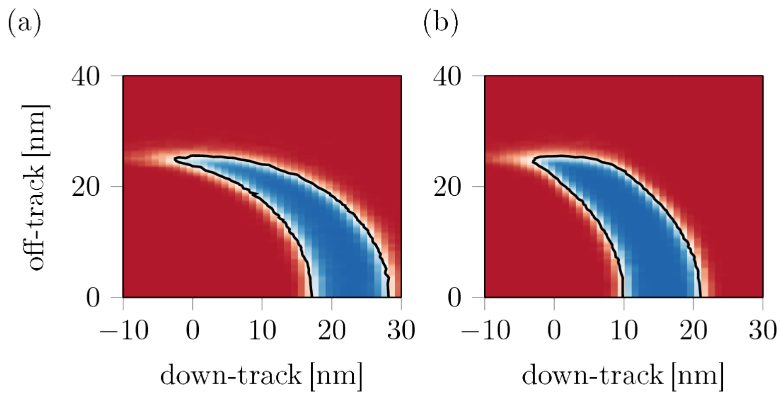

Figure 1. Demonstration of transition curvature reduction: Footprint of (a) a state-of-the-art HAMR head and (b) the same head with a reversed inductive write element.

[1] C. Vogler, C. Abert, F. Bruckner, D. Suess, Phys. Rev. B 90, 214431 (2014).
[2] C. Vogler, C. Abert, F. Bruckner, D. Suess, D. Praetorius, J. Appl. Phys 120, 153901 (2016).
[3] C. Vogler, C. Abert, F. Bruckner, and D. Suess, Appl. Phys. Lett. 110, 182406 (2017).