Magneto-Seebeck effect in RFeAsO (R = rare earth) compounds: Probing the magnon drag scenario

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In this work, we carried out a careful analysis of the Seebeck effect (S) in the 1111 (RFeAsO, with R=rare earth) parent compounds with different R and different degrees of disorder. We explored the dependences on temperature, observing a puzzled and articulated phenomenology (Figure 1 a)). The multiband character of these compounds seems to be insufficient to explain the behavior of the thermopower. In particular we elaborated a simplified model for the multiband diffusive contribution based on Mott-formula, verifying that it doesn't account for the local minimum around 50 K. To study this feature we performed some measurements of Seebeck effect as a function of magnetic field up to 30 T (Figure 1 b)) at the HFML laboratories of Nijmegen. The Seebeck values increase in magnitude with rising the field with a tendency to saturation observed at the low temperature. For this scenario we propose an interpretation based on magnon-drag by antiferromagnetic spin waves. To support our thesis we have developed a theoretical model for AFM-magnon drag contribution, identifying a scaling behavior as a function of the ratio B/T, well obeyed by experimental data (Figure 1 c)). The existence of a dominating magnon-drag contribution in the 1111-parent compounds is an important evidence of the strong interaction between charge carriers and spin waves. Within this picture the Seebeck effect comes out to be a privileged property which effectively probes the coupling mechanisms supposed to induce unconventional superconductivity.

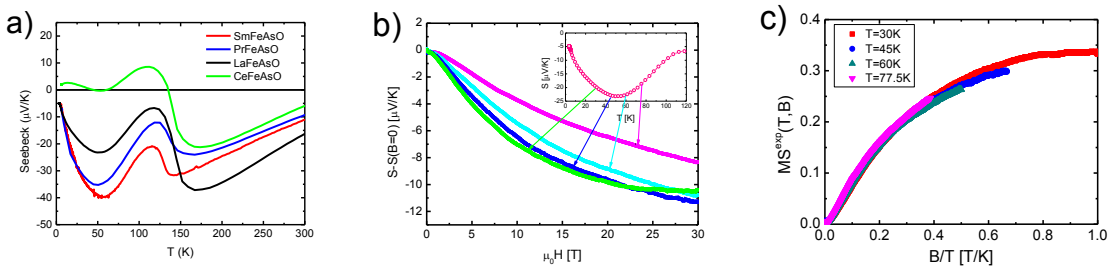

Figure 1: a) (Color online) Seebeck coefficient curves of RFeAsO (R = Sm, Pr, La, Ce) polycrystals, b) (Color online) S curves versus the magnetic field of theLaFeAsO sample performed at T = 30, 45, 60, and 77 K c) (Color online) AFM magnon drag contribution to the Seebeck effect $MS^{exp}(T,B)=[S(T,B)-S(T,0)]/S_{DRAG}(T)$ extracted from the experimental S curves of Fig. 1 b) and plotted as a function of B/T.