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Observation of the Spin Nernst Effect in Platinum[1]

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Thermoelectric effects – arising from the interplay between thermal and charge transport phenomena – have been extensively studied and are considered well established. Upon taking into account the spin degree of freedom, however, qualitatively new phenomena arise. A prototype example for these so-called magneto-thermoelectric or spin-caloritronic effects is the spin Seebeck effect, in which a thermal gradient drives a pure spin current. In contrast to their thermoelectric counterparts, not all the spin-caloritronic effects predicted from theory have yet been observed in experiment. One of these 'missing' phenomena is the spin Nernst effect, in which a thermal gradient gives rise to a transverse pure spin current. We have observed the spin Nernst effect in yttrium iron garnet/platinum (YIG/Pt) thin film bilayers. Upon applying a thermal gradient within the YIG/Pt bilayer plane, a pure spin current flows in the direction orthogonal to the thermal drive. We detect this spin current as a thermopower voltage, generated via magnetization-orientation dependent spin transfer into the adjacent YIG layer. Our data shows that the spin Nernst and the spin Hall effect in in Pt have different sign, but comparable magnitude, in agreement with first-principles calculations.

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