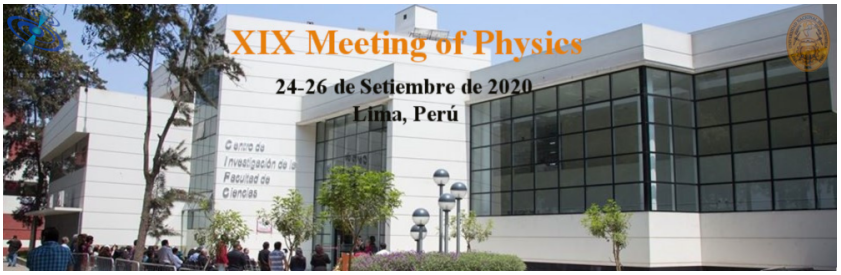

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Manipulation of spin currents with synthetic antferromagnets

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The adaptability of synthetic antiferromagnets (SAF) in spintronic devices based on spin Hall effects has emerged during the last years. In this work we report the use of a SAF (antiferromagnetically exchange coupled Co/Ru/Co) as a spin current injector and the observation of spin pumping and inverse spin Hall effect in [SAF]/Pt heterostructures [1,2]. By exploiting the interlayer exchange coupling strength (oscillatory RKKY-like coupling) and the spin-flop transition in the magnetization process of the SAF it is possible to rotate the magnetization of the Co layers at given angles away from the external magnetic field direction in resonance condition. The misalignment due to the spin-flop magnetization process combined with the spin pumping and the inverse spin Hall effect, allow to control and detect the polarization direction of the spin current pumped into the Pt. The control of the polarization direction of the spin current was also achieved by controlling the interlayer exchange coupling (IEC) via variations in the Ru spacer in the SAF-Pt system. By controlling the IEC strength and the spin flop transition in the magnetization process, it is also possible to produce spin currents polarized in different directions. Our results can lead to important advances in hybrid spintronic devices with improved functionalities, particularly the ability to control the polarization direction of spin currents and also the change of the sign of the inverse spin Hall effect signal induced in a metallic layer with the strong spin-orbit interaction.

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