

Orbital to charge current conversion in copper oxide heterostructures.

Smiljan Vojkovic^{1,2}, Khris Cancino^{2,3}, Gerardo Rodriguez^{2,3}, Erick Burgos³, Guillermo Herrera³, Claudio Gonzalez-Fuentes¹, Juan Luis Palma⁴, T. V. M. Sreekanth⁵, Juliano Denardin^{2,3}, Roberto Rodríguez-Suárez¹ and Simón Oyarzún^{2,3*}

¹ Facultad de Física, Pontificia Universidad Católica de Chile, Chile

² Centro de Nanociencia y Nanotecnología (CEDENNA), Santiago, Chile

³ Departamento de Física, Universidad de Santiago de Chile, USACH, Chile

⁴ Centro de Investigación en Ingeniería de Materiales CIEMAT, Universidad Central de Chile, Chile

⁵ School of Mechanical Engineering, Yeungnam University, Gyeongsan-si 38541, Republic of Korea

*simon.oyarzun@usach.cl

We report orbital-to-charge current conversion in CoFeB/CuO bilayers investigated via ferromagnetic resonance (FMR). Under FMR conditions, the precessing magnetization in CoFeB injects orbital angular momentum into the adjacent CuO layer, generating a transverse dc voltage through the inverse orbital Hall effect (IOHE) [1].

Figure 1 presents the quantitative comparison between the measured symmetric voltage and the orbital diffusion model as a function of CuO thickness. The voltage increases for thin layers and saturates beyond several nanometers, consistent with diffusive orbital transport with relaxation. From this analysis, we extract an orbital diffusion length of 6 nm and an orbital Hall angle of approximately 2%. Broadband FMR measurements reveal a small but finite damping enhancement, consistent with CuO acting as an orbital angular momentum sink.

These findings demonstrate robust diffusive orbital transport in fully oxidized CuO and establish transition-metal oxides as promising platforms for orbitronic devices based on orbital angular momentum transfer and conversion.

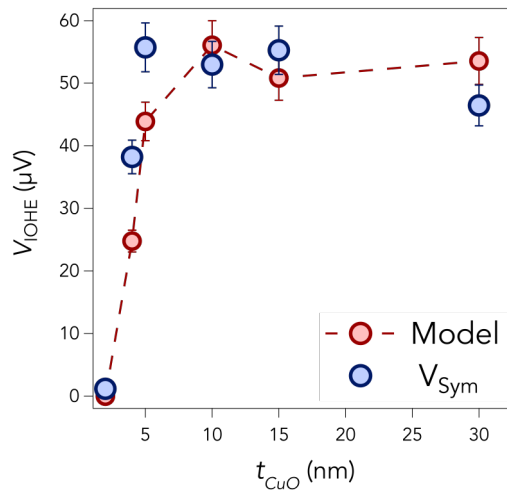


Figure 1. Blue circles correspond to the symmetric voltage component V_{Sym} as a function of the CuO thickness t_{CuO} , showing an increasing trend from 2 to 30 nm. Red circles correspond to the values obtained for the voltage using the orbital diffusion model.

[1] H. Hayashi, D. Go, S. Haku, Y. Mokrousov, K. Ando. *Observation of orbital pumping*. Nature Electronics 7, 646–652 (2024).