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**Zitterbewegung in Cold Atoms**<sup>1</sup> POLIANA PENTEADO, J. CARLOS EGUES, Institute of Physics of São Carlos, University of São Paulo — In condensed matter systems, the coupling between spatial and spin degrees of freedom through the spin-orbit (SO) interaction offers the possibility of manipulating the electron spin via its orbital motion. The proposal by Datta and Das [1,2] of a ‘spin transistor’ for example, highlights the use of the SO interaction to control the electron spin via electrical means. Recently, arrangements of crossed lasers and magnetic fields have been used to trap and cool atoms in optical lattices and also to create light-induced gauge potentials [3], which mimic the SO interactions in real solids. In this work, we investigate the Zitterbewegung in cold atoms by starting from the effective SO Hamiltonian derived in Ref. [4]. Cross-dressed atoms as effective spins can provide a proper setting in which to observe this effect, as the relevant parameter range of SO strengths may be more easily attainable in this context. We find a variety of peculiar Zitterbewegung orbits in real and pseudo-spin spaces, e.g., cycloids and ellipses - all of which obtained with realistic parameters.

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- [2] J. Carlos Egues, et. al., Appl. Phys. Lett. 82, 2658 (2003);
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