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Magnetization Ratchet in Cylindrical Nanowires

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The unidirectional motion of information carriers such as domain walls in magnetic nanostrips is a key feature for many future spintronic applications based on shift registers. This magnetic ratchet effect has been so far achieved in limited number of complex nanomagnetic structures for example by lithographically engineered pinning sites [1-3]. Here we report on simple remagnetization ratchet originated in the asymmetric potential from the designed increasing lengths of magnetostatically coupled ferromagnetic segments in FeCo/Cu cylindrical nanowires [4]. The magnetization reversal in neighboring segments propagates sequentially in steps starting from the shorter segments, irrespective of the applied field direction. This natural and efficient ratchet offers alternatives for the design of three-dimensional advanced storage and logic devices.

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