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Ratchet effect in a conformal pinning array BOLDIZSAR JANKO, DIPANJAN RAY, University of Notre Dame, CYNTHIA OLSON REICHHARDT, CHARLES REICHHARDT, Los Alamos National Laboratory — Pinning arrays where the pinning sites are located at the vertices of a conformally transformed hexagonal lattice, also known as conformal pinning arrays (CPA), have recently been shown to greatly enhance the critical current of type-II superconductors both in simulation and in experiment¹. Here we show using molecular dynamics simulations that the differing flux-flow resistance of the CPA in the forward and reverse directions causes it to function as a highly effective vortex ratchet. We drive the vortices using an applied external ac current, and we find that the resulting dc output voltage for the CPA ratchet is larger than that for a random pinning array with a pinning gradient² by up to an order of magnitude. The enhancement is robust over a wide range of vortex densities, temperatures, and ac drive amplitudes and frequencies.

¹D. Ray et al, Phys. Rev. Lett. 110, 267001 (2013); Y. L. Wang et al, Phys. Rev. B 87, 220501(R) (2013); S. Guenon et al, Appl. Phys. Lett. 102, 252602 (2013).

²C. J. Olson et al, Phys. Rev. Lett. 87, 177002 (2001).

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