

Abstract Submitted  
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**Signatures of spatial inversion asymmetry of an optical lattice observed in matter-wave diffraction**<sup>1</sup> CLAIRE K. THOMAS, THOMAS H. BARTER, TSZ HIM LEUNG, MASAYUKI OKANO, DAN M. STAMPER-KURN, Univ of California - Berkeley — The structure of a two-dimensional honeycomb optical lattice potential with small inversion asymmetry is characterized using coherent diffraction of <sup>87</sup>Rb atoms. We demonstrate that even a small potential asymmetry, with peak-to-peak amplitude of  $\leq 2.3\%$  of the overall lattice potential, can lead to pronounced inversion asymmetry in the momentum-space diffraction pattern. The observed asymmetry is explained quantitatively by considering both Kaptiza-Dirac scattering in the Raman-Nath regime, and also either perturbative or full-numerical treatment of the band structure of a periodic potential with a weak inversion symmetry breaking term. Our results have relevance both for the experimental development of coherent atom optics and also for the proper interpretation of time-of-flight assays of atomic materials in optical lattices.

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