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Probing an ultracold atomic crystal with matter waves[1] BRYCE GADWAY, DANIEL PERTOT, JEREMY REEVES, DOMINIK SCHNEBLE, Stony Brook University — We explore the scattering of matter waves from ultracold atoms held in an optical lattice. By "shining" a one-dimensional Bose gas onto an atomic Mott insulator (target), we observe Bragg diffraction peaks that reveal the target's crystalline structure. We find a systematic dependence of the Bragg peak intensity on the degree of atom localization, and recover a transition to coherent momentum and energy exchange ("Newton's cradle") in the limit of free target atoms. Neutral-atom diffraction can serve as a novel experimental technique for probing atomic many-body systems.

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