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Mapping atomic arrays in crystals by interpreting electron diffraction patterns BRYAN NEAL, NICK LANNING, WILLIAM WARE, SPENCER WIGGINTON, CHRIS LEE, CRISTIAN BAHRIM, Department of Physics, Lamar University, Beaumont, TX — Analyzing diffraction of light and electrons allows one to map the geometric structure of nettings and crystals. There is a strong analogy between light and electron diffraction because in both cases the diffraction angles are small and the patterns may be described as images of a Fourier transform. Light diffraction patterns may be interpreted as the optical transforms of 2D-nettings and therefore are simpler to understand. The interpretation of electron diffraction patterns is more sophisticated and requires the visualization of the crystal's reciprocal lattice using vector algebra. With light we can analyze the redistribution of energy in diffraction patterns. Our studies indicate a deviation of about 1% from the exact conservation of energy when the ratio between slit width and slit separation approaches 1. Such a deviation is expected to show up in electron diffraction patterns produced by super dense materials. We focused our studies on electron diffraction by graphite for understanding the mechanism of electron transmission through Carbon atoms. From measuring diffraction patterns and applying the Heisenberg Uncertainty Principle, we are able to estimate the atomic transmission time of the projectile electron and the group velocity of the electron passing through the crystal. Finally, our analysis leads to the estimation of the C-C bond in a hexagonal closed-packed (hcp) graphite crystal and the volume of the Carbon atom which diffracts the projectile electron. Sponsored by the STAIRSTEP-NSF-DUE grant# 0757057.

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