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Many-Impurity Effects in Fourier Transform Scanning Tunneling Spectroscopy WILLIAM ATKINSON, Trent University — Fourier transform scanning tunneling spectroscopy (FTSTS) is a useful technique for extracting details of the momentum-resolved electronic band structure from inhomogeneities in the local density of states due to disorder-related quasiparticle scattering. To a large extent, current understanding of FTSTS is based on models of Friedel oscillations near isolated impurities. Here, a framework for understanding many-impurity effects is developed based on a systematic treatment of the variance $\Delta\rho^2(\mathbf{q},\omega)$ of the Fourier transformed local density of states $\rho(\mathbf{q},\omega)$. One important consequence of this work is a demonstration that the poor signal-to-noise ratio inherent in $\rho(\mathbf{q},\omega)$ due to randomness in impurity positions can be eliminated by configuration averaging $\Delta\rho^2(\mathbf{q},\omega)$. Furthermore, we develop a diagrammatic perturbation theory for $\Delta\rho^2(\mathbf{q},\omega)$ and show that an important bulk quantity, the mean-free-path, can be extracted from FTSTS experiments.

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