

Abstract Submitted  
for the MAR13 Meeting of  
The American Physical Society

**Dual fermion method for disordered electronic systems** HANNA TERLETSKA, Brookhaven National Laboratory, SHUXIANG YANG, ZI YANG MENG, JUANA MORENO, MARK JARRELL, Louisiana State University — While the coherent potential approximation (CPA) is the most commonly used theoretical method to study disordered systems, it by construction misses non-local correlations and Anderson localization. We have recently extended the dual fermion approach [1] to disordered non-interacting systems using the replica method, which allows one to include such non-local physics. Our method utilizes an exact transform to the dual variables, and includes inter-site scattering via diagrammatic perturbation theory in dual fermion space, with the CPA being a zeroth-order approximation. Analyzing one-particle quantities we demonstrate good agreement between our results and those from the dynamical cluster extension of the CPA. Moreover, by calculating the dc conductivity we show that our approach successfully captures weak localization missing in the CPA. This method as a natural extension of CPA, and presents a powerful alternative to existing cluster extensions of CPA. It can be used in various applications, including systems with disorder and interactions.

[1] A.N. Rubtsov, et. al., Phys. Rev. B 77, 033101 (2008).

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Date submitted: 13 Nov 2012

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