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On the averaged Green's function of an elliptic equation with random coefficients

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We consider a divergence-form elliptic difference operator on the lattice $\mathbb{Z}^d$, with a coefficient matrix that is an i.i.d. perturbation of the identity matrix. Recently, Bourgain introduced novel techniques from harmonic analysis to prove the convergence of the Feshbach-Schur perturbation series related to the averaged Green's function of this model. Our main contribution is a refinement of Bourgain's approach which improves the key decay rate from $-2d+\varepsilon$ to $-3d+\varepsilon$. (The optimal decay rate is conjectured to be $-3d$.) As an application, we derive estimates on higher derivatives of the averaged Green's function which go beyond the second derivatives considered by Delmotte-Deuschel and related works.

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