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Elliptic difference equations with random coefficients

It is a classical result that Green's functions for uniformly elliptic partial differential equations in divergence form are controlled by the Green's function for the Laplace's equation. When the coefficients are random variables, better regularity results are available for averaged Green's functions both in continuous and discrete settings. In this talk, we consider the averaged Green's function for an elliptic difference operator on the lattice $\mathbb{Z}^d$ with a coefficient matrix that is an i.i.d. perturbation of the identity matrix. In this setting, Bourgain proved a decay estimate for the kernel of an averaged operator which governs the averaged solution. We present some ingredients of his proof and also an improved estimate. As a corollary, sharp decay estimates for higher order derivatives of the averaged Green's function are shown to be valid up to $d + 1$ derivatives. This is a joint work with Marius Lemm.