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A novel approach to homogenization

In 2017, Bourgain introduced novel techniques from harmonic analysis to study divergence-form operators on \mathbb{Z}^d with weakly random coefficients. In joint work with Jongchon Kim, we refined Bourgain's argument, improving the key decay rate of the effective diffusion matrix from $-2d+\epsilon$ to $-3d+\epsilon$, with $-3d$ conjecturally optimal. With Duerinckx and Gloria, we observed that these results correspond to an unforeseen refinement in homogenization theory for the asymptotic description of the averaged solution. Notably, this correspondence by itself does not require weak randomness.