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Harmonic Cocycle and Random Walk on Groups

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Shalom's property HFD is a very intriguing property for groups (discrete or locally compact) which sits at the crossroads of analysis, geometry, and algebra. It is defined in terms of analysis (through the unitary representation theory) and turns out to be a geometric property (a quasi-isometry invariant among amenable groups), and has algebraic consequences (has a virtually- \mathbb{Z} quotient).

After reviewing these facts, I will talk on the characterization of property HFD in terms of the growth rate of harmonic cocycles along random walk trajectories. As a consequence, some handy sufficient conditions of property HFD are obtained purely in terms of random walks. The lecture is mainly based on the following references.

1. A. Erschler and N. Ozawa; Finite-dimensional representations constructed from random walks. Preprint. arXiv:1609.08585
2. N. Ozawa; A functional analysis proof of Gromov's polynomial growth theorem. *Ann. Sci. Ec. Norm. Super.* **4**, to appear. arXiv:1510.04223
3. Y. Shalom; Harmonic analysis, cohomology, and the large-scale geometry of amenable groups. *Acta Math.* **192** (2004), 119–185.