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The sound of random graphs

Infinite random graphs, such as Galton-Watson trees and percolation clusters may have real numbers that are eigenvalues with probability one, providing a consistent "sound". These numbers correspond to atoms in their density-of-states measure.

When does the sound exist? When are there only finitely many atoms? When is the measure purely atomic? I will review many examples and show some elementary techniques for studying these problems, including some developed in joint works with Charles Bordenave and Arnab Sen. The last question is open for percolation clusters in Z^d, $d \geq 3$, and for incipient Galton-Watson trees.