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Cantor Spectrum of Quasi-periodic Schrödinger Operators

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Quasi-periodic environments are situated between (simple) periodic environments and (complex) random environments. Schrödinger operators with quasi-periodic potentials possess significant quantum physical backgrounds, such as the quantum Hall effect, quasicrystals, and topological insulators. The Cantor spectrum is a spectral phenomenon predominantly observed in quasi-periodic Schrödinger operators and forms the basis for the logic underlying the integer quantum Hall effect. Owing to its profound mathematical richness, the quasi-periodic Schrödinger operator has garnered attention from numerous distinguished mathematicians, including Moser, Sinai, Bourgain, Spencer and Avila. This report aims to present our recent advancements in the study of Cantor spectra, encompassing the Dry Ten Martini problem, robust Cantor spectrum, quantitative global theory, and estimates of spectral gaps.

The findings are based on several recent collaborative efforts with Avila, Ge Lingrui, Leguil, Jitomirskaya, Zhao Zhiyan, and Zhou Qi.