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Energy Trans-series of Hofstadter Butterfly from Supersymmetric Field Theory

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Electron in a 2d square lattice immersed in a perpendicular magnetic field is known to exhibit a fractal energy spectrum known as the Hofstadter Butterfly. To account for this interesting energy spectrum nonperturbative corrections must be taken into account. We capitalise on an interesting connection between Hofstadter butterfly and 5d supersymmetry field theory, and by making use of the resurgent structure and the BPS spectrum of the 5d gauge theory, we are able to construct the full energy trans-series of Hofstadter butterfly that includes all the non-perturbative corrections when the magnetic flux through a lattice plaquette is $2\pi/Z$.

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