

Complex Resonances in Josephson Photonics

Ben Lang and Andrew Armour

University of Nottingham, University Park, Nottingham, United Kingdom

We explore theoretically the dissipative dynamics of nonlinearly driven oscillator systems tuned to resonances where multiple excitations are generated. Such systems are readily realised in circuit QED systems combining Josephson junctions with a microwave cavity and a drive achieved either through flux or voltage bias. For resonances involving 3 or more photons the system undergoes a sequence of two closely spaced dynamical transitions (the first one discontinuous and the second continuous) as the driving is increased leading to steady states that form complex periodic structures in phase space. In the vicinity of the transitions the system displays interesting bistable behaviour: we find that coherent effects can lead to surprising oscillations in the weight of the different dynamical states in the steady state of the system with increasing drive.