Engineering inverse power law decoherence of a qubit
FRANCESCO PETRUCCIONE, FILIPPO GIRALDI, University of KwaZulu-Natal and National Institute for Theoretical Physics, QUANTUM RESEARCH GROUP TEAM — The exact dynamics of a Jaynes-Cummings model for a qubit interacting with a bath of bosons, characterized by a special form of the spectral density, is evaluated analytically. The special reservoirs are sub-ohmic at low frequencies and inverse power law at high frequencies. The exact dynamics of the qubit is described analytically through Fox H-functions. Over estimated long time scales, decoherence results in inverse power laws with powers decreasing continuously to unity, according to the particular choice of the engineered reservoir. If compared to the exponential-like relaxation obtained from the original Jaynes-Cummings model for Lorentzian-type spectral density functions, decoherence is considerably hindered.