Demonstration of Microwave Resonant Activation in large MgB_2-based thin film Josephson Junctions

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The current-biased Josephson junction has been used as a testbed for studying resonant activation, or the escape of a Brownian motion particle from a potential well. As bias current is increased, the voltage across the junction switches from zero to a finite voltage. This is analogous to the escape of a phase particle originally oscillating with a plasma frequency ω in a washboard potential well, to the running state. Resonant activation has been observed in Al, Nb and high-T_c junctions. We report the first resonant activation data results using large MgB_2/I/Pb thin film junctions, where we demonstrate good control over the escape of the phase particle using microwave frequency and power. Our results exhibit features in the escape rate suggestive of substructure within the π gap of MgB_2, which is consistent with our recent work demonstrating sub-structure within the π and σ energy gaps of MgB_2.[1]

[1]Carabello, S., Lambert, J.G., Mlack, J.T., and Ramos, R.C., Differential Conductance Measurements of MgB_2-Based Josephson Junctions Below 1 Kelvin, IEEE/CSC & ESAS European Superconductivity News Forum (ESNF), No. 15, January 2011.