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Phase Dynamics in a Two-Plaquette Josephson Junction Array ZIJIE POH, Ohio Wesleyan University, MA'AYAN DAGAN, Oberlin College, JEANETTE VELDMAN, Central College, BRAD TREES, Ohio Wesleyan University — We study numerically and analytically the phase dynamics of two coupled plaquettes of Josephson junctions shunted by another junction. A plaquette is a square with a junction on each side. This geometry is motivated by single crystal Bismuth Strontium Calcium Copper Oxide (BSCCO), a layered high-T_c superconductor consisting of hundred or thousands of intrinsic Josephoson junctions. The coupled plaquettes of our analysis are a simple model for two neighboring BSCCO crystals. We look for evidence of both frequency and phase synchronization in the dynamic (oscillating) junctions of the plaquettes. We find numerical evidence that intra-plaquette synchronization can be obtained even with weak coupling between the junctions in a plaquette and without the shunting junction. However, the shunting junction is crucial for synchronization between the junctions in neighboring plaquettes (inter-plaquette synchronization). Analytically, we use perturbation theory and a multiple time-scale analysis to predict the combinations of junction parameters for which phase synchronization appears in the array. By this analytical approach, we successfully capture the intra-plaquette synchronization behavior. The analytic study of inter-plaquette synchronization is still in progress.

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