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Neural dynamics in superconducting networks KENNETH SEGALL[1], Colgate University, DAN SCHULT[2], Colgate Universtiy, PATRICK CROTTY[3], MAX MILLER[4], Colgate University — We discuss the use of Josephson junction networks as analog models for simulating neuron behaviors. A single unit called a "Josephson Junction neuron" composed of two Josephson junctions [1] displays behavior that shows characteristics of single neurons such as action potentials, thresholds and refractory periods. Synapses can be modeled as passive filters and can be used to connect neurons together. The sign of the bias current to the Josephson neuron can be used to determine if the neuron is excitatory or inhibitory. Due to the intrinsic speed of Josephson junctions and their scaling properties as analog models, a large network of Josephson neurons measured over typical lab times contains dynamics which would essentially be impossible to calculate on a computer We discuss the operating principle of the Josephson neuron, coupling Josephson neurons together to make large networks, and the Kuramoto-like synchronization of a system of disordered junctions.

[1] "Josephson junction simulation of neurons," P. Crotty, D. Schult and K. Segall, Physical Review E 82, 011914 (2010).

[1]Department of Physics and Astronomy
[2]Department of Mathematics
[3]Department of Physics and Astronomy
[4]Department of Physics and Astronomy

Kenneth Segall
Colgate University

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