# Ferromagnetic Josephson Junctions for Cryogenic Memory

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***Abstract*— Large-scale computing facilities and data centers are using electrical power at an ever-increasing rate. Current projections suggest that a future exascale computer will require the power output of a typical nuclear power plant [1]—clearly an untenable situation. One approach to addressing this problem is to build a superconducting computer based on single-flux-quantum logic. Designing a high-density memory for such a computer is a major challenge. One approach is to use Josephson junctions containing ferromagnetic (F) materials as the basic memory element for such a memory [2]. The basic device is a Josephson junction containing two ferromagnetic layers whose magnetization directions can be switched between being parallel or antiparallel to each other, just as in a conventional spin valve. If the thicknesses of the ferromagnetic layers are chosen appropriately, those two magnetic states will result in the junction having a ground-state superconducting phase difference of either 0 or π. We have recently demonstrated that such a junction can indeed be controllably switched between the "0" phase state and the "π" phase state, from measurements of two junctions in a SQUID geometry [3]. We will report on our continued progress in optimizing this system.**

Acknowledgment:
This research is supported by the Office of the Director of National Intelligence (ODNI), Intelligence Advanced Research Projects Activity (IARPA), via U.S. Army Research Office contract W911NF-14-C-0115.

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***Keywords (Index Terms)*— Josephson Junctions, superconducting phase control, single flux quantum logic, cryogenic memory, superconducting/ferromagnetic hybrid systems.**

IEEE/CSC & ESAS SUPERCONDUCTIVITY NEWS FORUM (global edition), July 2017.
Received June 23, 2017; Selected July 22, 2017. Reference STP586; Category 4.
This invited oral presentation Tu-I-SSP-04 was given at ISEC 2017.