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On-chip microwave circulators - Breaking time-reversal symmetry with quantum phase slips CLEMENS MÜLLER, ARC Centre of Excellence for Engineered Quantum Systems, The University of Queensland, Brisbane, Australia, NICOLAS VOGT, JARED H. COLE, Chemical and Quantum Physics, School of Science, RMIT University, Melbourne, Australia, THOMAS M. STACE, ARC Centre of Excellence for Engineered Quantum Systems, The University of Queensland, Brisbane, Australia — Quantum phase slip (QPS) junctions are dual circuit-elements that are equivalent to Josephson junctions under the exchange of voltage and current[1] and they have recently been employed to observe coherent quantum phase slips[2]. We propose a QPS-junction based circulator, where the three ports of the circulator are inductively connected to superconducting loops hosting trapped flux quanta. The role of a symmetry-breaking magnetic field is played by an external gate charge on a central island. The design is similar to one previously proposed using Josephson junctions[3], but exchanges the charge and flux degrees of freedom. The QPS circulator therefore is much less sensitive to environmental perturbations, since fluctuations in background magnetic flux are many orders of magnitude suppressed as compared to charge fluctuations. We find that our design offers high isolation even when taking into account realistic fabrication imperfections and experimental conditions and find a circulator bandwidth in excess of 400MHz for standard device parameters.

[1]Mooij et al, Nat.Phys. 2, 169 (2006)
[2]Astafiev et al, Nature 484, 355 (2012)
[3]Koch et al, PRA 82, 043811 (2010)

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