Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Advances in quantum Hall-effect gyrators and circulators STEFANO BOSCO, DAVID P. DIVINCENZO, RWTH Aachen — Gyrators and circulators are non-reciprocal devices required for measurement and control of solid state qubits. The current implementation of circulators exploits the Faraday effect: although this guarantees very good performance in terms of loss, the resulting devices are quite bulky in the microwave regime. Better scalability can be achieved by using the quantum Hall-effect: a system made of metal electrodes capacitively coupled to a Hall-bar is expected to behave as an ideal non-reciprocal device at specific frequencies. In this talk, I will present the latest theoretical developments in this field, focusing on both physical and engineering aspects. In particular, I will discuss a general modeling of these devices based on microscopic calculations in the random phase approximation that captures several interesting features of the response in different materials, including graphene. I will also tackle some practical issues, for example the impedance mismatch with the external circuit and the parasitic coupling between the electrodes. Although these effects are typically expected to degrade the performance, clever engineering of the coupling between the electrodes and the Hall-bar can suppress them and optimal devices can be implemented without additional bulky electronics.

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Date submitted: 09 Nov 2016 Electronic form version 1.4