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Implementing quantum phase gates with Ising anyons DAVID J. CLARKE, KIRILL SHTENGEL, University of California, Riverside — Non-Abelian anyons of Ising type are likely to occur in a number of physical systems, including quantum Hall systems, where recent experiments support their existence. In general, non-Abelian anyons may be utilized to provide a topologically error-protected medium for quantum information processing. However, the topologically protected operations that may be obtained by braiding and measuring topological charge of Ising anyons are not computationally universal. Nevertheless they can be made universal when supplemented with a single-qubit phase gate. We propose a method of implementing arbitrary single qubit phase gates for Ising anyons by utilizing interference of auxiliary anyons around computational anyons. While this gate is not topologically protected, our estimates show that its error rate can be made lower than the threshold for error correction. The error rate for systems with neutral Ising anyons (e.g. topological insulator) is inherently lower than that for systems in which the anyons carry charge (e.g. quantum Hall systems).

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