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Dynamic Phases and Robust Quantum Gates[1] YASUSHI KONDO, TSUBASA ICHIKAWA, MASAMITSU BANDO, MIKIO NAKAHARA, Kinki University — We are interested in composite pulses widely employed in Nuclear Magnetic Resonance (NMR) and geometric phase gates (GQGs) with vanishing dynamic phases in Quantum Information Processing (QIP). A composite pulse in NMR is constructed with poor quality pulses but becomes more reliable than its components. We found: a composite pulse robust against pulse length error in NMR is always a GQG [1]. We then extended this observation to two-qubit operations. Let us consider the interaction $e^{-i\theta\sigma_z\otimes\sigma_z}$ and assume that there is a systematic error in θ. When we construct a "composite pulse" robust against this error, we obtain a two-qubit GQG [2]. We clarified that geometric phase gates are really useful in QIT.

[1]Y. Kondo & M. Bando, *J. Phys. Soc. Jpn.* **80**, 054002.
[2] T. Ichikawa, M. Bando, Y. Kondo & M. Nakahara, submitted to *philosophical transaction* A.

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