Quantized vortices in a rotating Bose-Einstein condensate with spatiotemporally modulated interaction

Deng-Shan Wang, Shu-Wei Song, Bo Xiong, and W. M. Liu
Beijing National Laboratory for Condensed Matter Physics,
Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China
(Dated: July 14, 2011)

We present theoretical analysis and numerical studies of the quantized vortices in a rotating Bose-Einstein condensate with spatiotemporally modulated interaction in harmonic and anharmonic potentials, respectively. The exact solutions of quantized vortex and giant vortex are constructed explicitly by similarity transformation. Their stability behavior has been examined by numerical simulation, which shows that a new series of stable vortex states (defined by radial and angular quantum numbers) can be supported by the spatiotemporally modulated interaction in this system. We find that there exist stable quantized vortices with large topological charges in repulsive condensates with spatiotemporally modulated interaction. We also give an experimental protocol to observe these vortex states in future experiments.