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Phase Diagram of Solitons in the Polar Phase of a Spin-1 Bose-Einstein Condensate[1] SHIH-CHUAN GOU, Department of Physics and Graduate Institute of Photonics, National Changhua University of Education, Taiwan, I-KANG LIU, School of Mathematics, Statistics and Physics, Newcastle University, United Kingdom, HIROMITSU TAKEUCHI, Department of Physics and Nambu Yoichiro Institute of Theoretical and Experimental Physics (NITEP), Osaka City University, Japan — We theoretically study the core structure of a stationary soliton, the building block of wall-vortex composite defects recently observed in the polar phase of spin-1 condensate [Seji Kang et. al., Phys. Rev. Lett. 122, 095301 (2019)], in the presence of quadratic Zeeman term. The phase diagram of such solitons is mapped out by locating the solutions of minimal soliton tension coefficient in the defining range of polar phase, and the states are distinguished into normal, anti-ferromagnetic, broken-axisymmetry, and ferromagnetic phases according to the number and spin densities of the core. Phase boundaries and the associated orders of phase transitions are determined and the critical behavior of the relevant continuous phase transitions is analyzed using Ginzburg-Landau theory.

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