

Abstract Submitted  
for the MAR13 Meeting of  
The American Physical Society

**3D quaternionic condensation and spin textures with Hopf invariants from synthetic spin-orbit coupling**<sup>1</sup> CONGJUN WU, YI LI, Department of Physics, University of California, San Diego, XIANGFA ZHOU, Key Laboratory of Quantum Information, University of Science and Technology of China, CAS, Hefei, Anhui 230026, China — We study unconventional condensations of two-component bosons in a harmonic trap subject to the 3D  $\vec{\sigma} \cdot \vec{p}$ -type spin-orbit (SO) coupling. The topology of condensate wavefunctions manifests in the quaternionic representation. The spatial distributions of the  $S^3$  quaternionic phase exhibit 3D skyrmion configurations, while those of the  $S^2$  spin orientation possess non-zero Hopf invariants. As increasing SO coupling strength, spin textures evolve from concentric distributions to lattice structures at weak interactions. Strong interactions change condensates into spin-polarized plane-wave states, or, superpositions of two plane-waves exhibiting helical spin spirals.

<sup>1</sup>This project is supported by AFOSR FA9550-11-1- 0067(YIP) and NSF-DMR-1105945.

Congjun Wu  
Department of Physics, University of California, San Diego

Date submitted: 09 Nov 2012

Electronic form version 1.4