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Topological Nodal-Line Superfluid in Spin-Orbit Coupled Cold Atomic Systems WEN-YU HE, DONG-HUI XU, TONG ZHOU, K. T. LAW, Hong Kong University of Science and Technology, HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY COLLABORATION — Topological nodal line superconductivity or superfluidity is a fascinating topological gapless phase which hosts bulk Weyl ring degeneracy in the quasiparticle excitation spectrum and supports Majorana zero bound modes with a large density of states at the edge. In this work, based on the experimental realized 1D spin orbit coupling, we show the emergence of topological nodal line superfluid phase in Fermionic atoms trapped in 3D cubic optical lattice when the s wave pairing field is introduced through Feshbach resonance between the two atomic hyperfine spin states. The nodal line degeneracy is further found to evolve into Weyl nodes once another component of spin orbit coupling field enters to break the chiral symmetry. The momentum resolved radio frequency spectroscopy is suggested to manifest the topological nodal line superfluid phase.

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