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Majorana surface and vortex states in three dimensional nodal noncentrosymmetric superconductors PO-YAO CHANG, Univ of Illinois - Urbana, SHUNJI MATSUURA, Departments of Physics and Mathematics, McGill University, Montreal, Quebec, Canada, ANDREAS SCHNYDER, Max-Planck-Institut für Festkörperforschung, SHINSEI RYU, Univ of Illinois - Urbana — We investigate Majorana surface and vortex states in three dimensional noncentrosymmetric superconductors (NCSs) that have antisymmetric spin-orbit coupling and exhibit an admixture of spin singlet and triplet superconducting pairings. By exact diagonalization of Bogoliubov-de Gennes Hamiltonians, we show different scenarios of Majorana surface and vortex states, which coexist with the surface flat bands originated from the nodal rings in the bulk: (i) there are no additional surface and vortex states; (ii) there are a Fermi arc on the surface and a flat band localized at the core of a vortex line; (iii) there are a Majorna cone state protected by a Z_2 topological invariant on the surface and a helical state localized at the core of a vortex line. By turning off the singlet superconducting pairing, these three different scenarios adiabatically connect to a trivial gapped superconductor, a nodal superconductor with two nodal points (a superconducting and time-reversal symmetric analogue of Weyl semimetal), and a fully gapped topological superconductor, respectively. The latter indicates NCSs can share interesting topological properties with fully gapped topological superconductors and widens the possibility of searching physics of topological superconductors in NCSs.

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