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Nodal $d+id$ pairing and topological phases on the triangular lattice: unconventional superconducting state of $\mathbf{Na}_x\mathbf{CoO}_2\cdot y\mathbf{H}_2\mathbf{O}$ SEN ZHOU, Florida State University, ZIQIANG WANG, Boston College — We show that the finite angular momentum pairing on the triangular lattice has point nodes in the complex gap function. A topological quantum phase transition takes place through a gapless critical state at a specific carrier density x_c where the normal state Fermi surface crosses these isolated nodes. For spin singlet pairing, we show that the second nearest neighbor $d+id$ pairing is the dominate superconducting channel. The gapless critical state appears at $x_c \simeq 0.25$ for the sodium cobaltates. It has six Dirac points and is topologically nontrivial with a T^3 spin relaxation rate below T_c. This theory provides a consistent explanation for the unconventional superconducting state of $\mathrm{Na}_x\mathrm{CoO}_2\cdot y\mathrm{H}_2\mathrm{O}$.

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