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Dipolar Bogolons: From Superfluids to Pfaffians SIDDHARTH PARAMESWARAN, UC Berkeley, STEVEN KIVELSON, Stanford University, R. SHANKAR, Yale University, SHIVAJI SONDHI, Princeton University, BORIS SPIVAK, University of Washington — We study neutral fermionic 'Bogolons' which are quasiparticle excitations of gapped phases that arise due to fermion (BCS) pairing, such as superfluids, superconductors, and paired quantum Hall states. As we demonstrate, a naïve construction of a quasiparticle wavepacket by solving the mean-field BCS equations leads to a contradiction: there is a net electrical current *even when the group velocity vanishes*. Resolution of this paradox requires the computation of supercurrents in the wavepacket state, typically a complicated exercise in self-consistency. In this Letter we demonstrate that these corrections may be approximately calculated from correlations in the mean-field ground state, and lead to a divergence-free, dipolar current pattern associated with the quasiparticle. When Maxwell electrodynamics is included, as appropriate to a superconductor, this pattern is confined over a penetration depth. For paired quantum Hall states of composite fermions, the Maxwell term is replaced by a Chern-Simons term, which leads to a dipolar *charge* distribution, paralleling Read's observation that composite fermions are neutral dipoles.

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