Abstract Submitted
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A singlet-pairing superconductor is always also a super-spin-current-conductor.[1] CHIA-REN HU, Texas A&M University — A heuristic argument and a simple theory are used to show that, as a fundamental difference between BEC and BCS condensation of fermion pairs, *the later, even for singlet pairing, can carry a sizable dissipation-less spin-current below practically the same* T_C. The heuristic argument is based on the similarity between a spin-current carried by a singlet-pairing condensate and (coherent) partner changing in a dancing hall. Simple theory: We consider singlet pairing in a normal metal carrying a moderate spin-current, which causes the spin-up- and -down Fermi surfaces (FSs) to be shifted in the momentum space by $\pm\mathbf{q}/2$. [(k,↑),(-k,↓)]-pairing is clearly still possible over the entire FSs. To favor a spin current in the system, we introduce a vector Lagrange multiplier $\mathbf{v}_{sp}$, and add -$\mathbf{v}_{sp}$·$\Sigma_{\ k,\sigma}\sigma$ h$\mathbf{k}$ $\mathbf{c}^{\dagger}_{k,\sigma}\mathbf{c}_{k,\sigma}$to the Hamiltonian. Since time-reversal invariance is not broken, negligible changes to all properties of the singlet-pairing state follow, and the system remains fully gapped. No depairing can be induced even for a sizable spin current. Two experimental tests of this prediction will be discussed.

[1]arXiv cond-mat/0711.3020.

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