A singlet-pairing superconductor is always also a super-spin-current-conductor.\textsuperscript{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 $\pm q/2$. $[(k,\uparrow),(-k,\downarrow)]$-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 $-\mathbf{v}_sp \Sigma_{k,\sigma,\sigma'} \hbar \mathbf{k} \mathbf{e}_{k,\sigma} \mathbf{e}_{k,\sigma}$ 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.

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