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Singularity in self-energy and composite fermion excitations of interacting electrons[1] JIAN-XIN ZHU, LIJUN ZHU, Los Alamos National Laboratory — We propose that a composite fermion operator $f_{i\sigma}(2n_{i\bar{\sigma}}-1)$ could have coherent excitations, where $f_{i\sigma}$ is the fermion operator for interacting electrons and $n_{i\bar{\sigma}}$ is the number operator of the opposite spin. In the two-impurity Anderson model, it is found that the excitation of this composite fermion has a pseudogap in the Kondo regime, and has a finite spectral weight in the regime where the excitation of the regular fermion $f_{i\sigma}$ has a pseudogap. In the latter regime, the self-energy of $f_{i\sigma}$ is found to be singular near Fermi energy. We argue that this composite fermion could develop a Fermi surface with Fermi liquid behaviors but "hidden" from charge excitations in lattice generalizations. We further illustrate that this type of excitations is essential in addressing the pseudogap state and unconventional superconductivity.

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