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Pairing in an one-dimensional interacting electron gas M. FORTES, Instituto de Fisica, Universidad Nacional Autonoma de Mexico, R. MENDOZA, Posgrado en Ciencias Fisicas, UNAM, M. A. SOLíS, Instituto de Fisica, UNAM —
We study an N-electron gas in one dimension with two electrons above, or two holes below, the Fermi surface interacting via a Cooper/BCS pairwise interaction model, taking full account of the Fermi sea of N-2 background electrons. We study the structure of possible Cooper-pair formation through the Bethe- Salpeter equation in the ladder approximation. When the unperturbed ground state is simply that of the ideal Fermi gas, we obtain the well-known result for the binding energy of electron pairs if hole pairs are completely ignored. Also obtained is a linear center-of-mass momentum, correction term leading to pair breakup for somewhat larger values for the total center-of-mass momentum, K. The same result but with opposite sign is obtained for a hole pair below the Fermi surface. But when both electron- and hole-pairs are considered via the same model interaction, no solution exists as the energy is purely imaginary. However, by performing a Bogoliubov transformation to replace the ideal Fermi gas sea as the unperturbed ground-state by a correlated BCS ground-state, two solutions are found. For sufficiently small K, we derive a highly-nontrivial solution of the moving Cooper pair which is also linearly-dispersive for small K. These results are consistent with similar calculations in 2D and 3D.

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