Sorella *et al.* Reply: We take the opportunity of this Reply to reject the criticism raised in the previous Comment [1] and to strengthen the validity of our findings [2]. The criticism to our work is summarized in two claims that we quote from the previous Comment: (i) "Their 2D data, although obtained by a slightly different vwf, are actually consistent with ours" and (ii) "...a reliable extrapolation method must demonstrate its ability to overcome the bias introduced in the vwf used. This is where we believe the method of in Ref. [2] has failed." We are going to refute both points.

(i) Our results are not consistent with the self-consistent method (SCM) proposed in Ref. [3]. According to the SCM, a reliable estimate of the order parameter can be obtained by tuning the variational d-wave parameter Δ of the initial wave function, so that the pairing correlation function at large distance remains approximately constant as we improve the variational energy with an iterative method (Lanczos and/or power method). As shown in Fig. 1, if we use the SCM by using only the first Lanczos iteration for the 26-site cluster (four holes), the starting variational wave function turns out to have a very bad energy (more than 50% higher than the best variational estimate for the same class of vwf) and a very small $\Delta \lesssim 0.02$, clearly underestimating the correct correlations by about a factor of 3.

The SCM is based on an assumption of monotonic behavior of the pairing correlations that is not verified in this case. The nonmonotonic behavior displayed by the SCM (triangles) prevents any possibility to extrapolate the variational results by use of the few Lanczos or power iterations attainable by the Monte Carlo method, while our techniques (circles) do. For closed shell cases, the SCM behaves reasonably well on small sizes (this bias is about 10% on 20 sites). However, we have found a factor 2 discrepancy for the pairing correlations of the 50-site cluster (8 holes, closed shell case) shown in Fig. 2 of Ref. [3]. Even though the solution is not known for this case, we believe that our results are definitely more reliable, being at much lower energies: Once the value $\Delta = 0.22$ is taken from Ref. [3], we have computed the corresponding energy per site $E/t = -0.8883(2)$, which is remarkably higher than our best variational energy $E/t = -0.9374(1)$, obtained with the fixed-node (FN) method. The SCM variational energy does not improve much by applying the best approximation used in Ref. [3] (one Lanczos step +4 powers), with a corresponding energy $E/t = -0.9167(6)$, which is even worse than applying two Lanczos steps and no powers to the same vwf [$E/t = -0.9198(1)$]. With such a poor initial wave function it is rather clear that simple iterative schemes such as the power or the Lanczos methods should face exactly the same problems encountered for the 26-site cluster. Instead, in order to check the stability of our ground state (GS) results, we systematically compared the pure variational method with a much more powerful GS technique: the FN method. In fact, the FN scheme allows one to obtain exact GS properties of an effective Hamiltonian — the FN one — chosen to be as close as possible to the exact one. For the case considered, it is enough to apply FN to the same high energy state found by the SCM and obtain an increase of P_d^{avg} of about a factor 2: $P_d^{\mathrm{avg}} = 0.0168(12)$, out of scale in the mentioned figure, rather close instead to our variance extrapolated value $P_d^{\mathrm{avg}} = 0.0200(8)$.

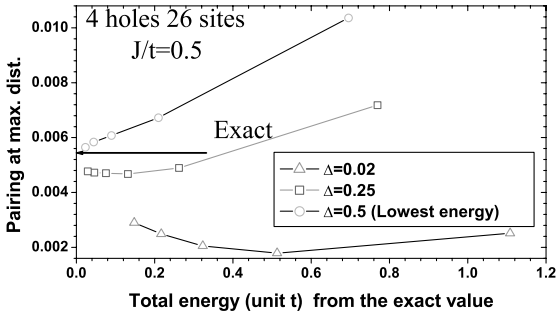

FIG. 1. Pairing correlations at maximum distance as obtained by the Lanczos method for three different initializations. Rightmost points refer to the vwf.

(ii) In order to reply to the criticism raised in the Comment about the reliability of our results, we just mention that systematic checks against the largest diagonalization results available (four holes in 26 sites) have been performed and shown here in Fig. 1 and in Fig. 2 of [2], while no similar comparison has been attempted, to our knowledge, using the SCM in the t-J model. The agreement between our method and Lanczos diagonalizations and DMRG (when exact) is always excellent. This should remove any doubt about the results presented in Ref. [2].

The conclusions of these comparisons are that the best route to the GS appears to be the one that minimizes the energy rather than the unnecessarily complicated SCM, at least in the relevant optimal doping, $J/t \simeq 0.5$ case.

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