Supplemental Material for: "Absence of off-diagonal long-range order in hcp ^{4}He dislocation cores"

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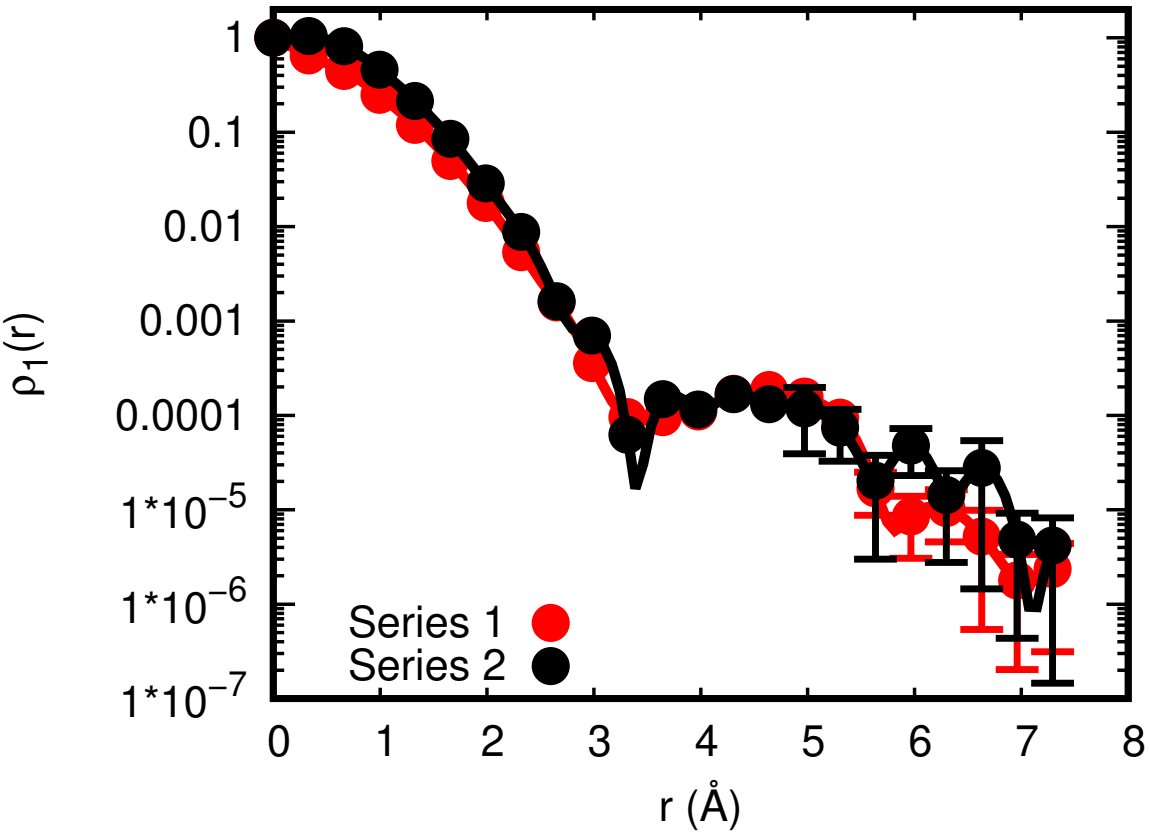
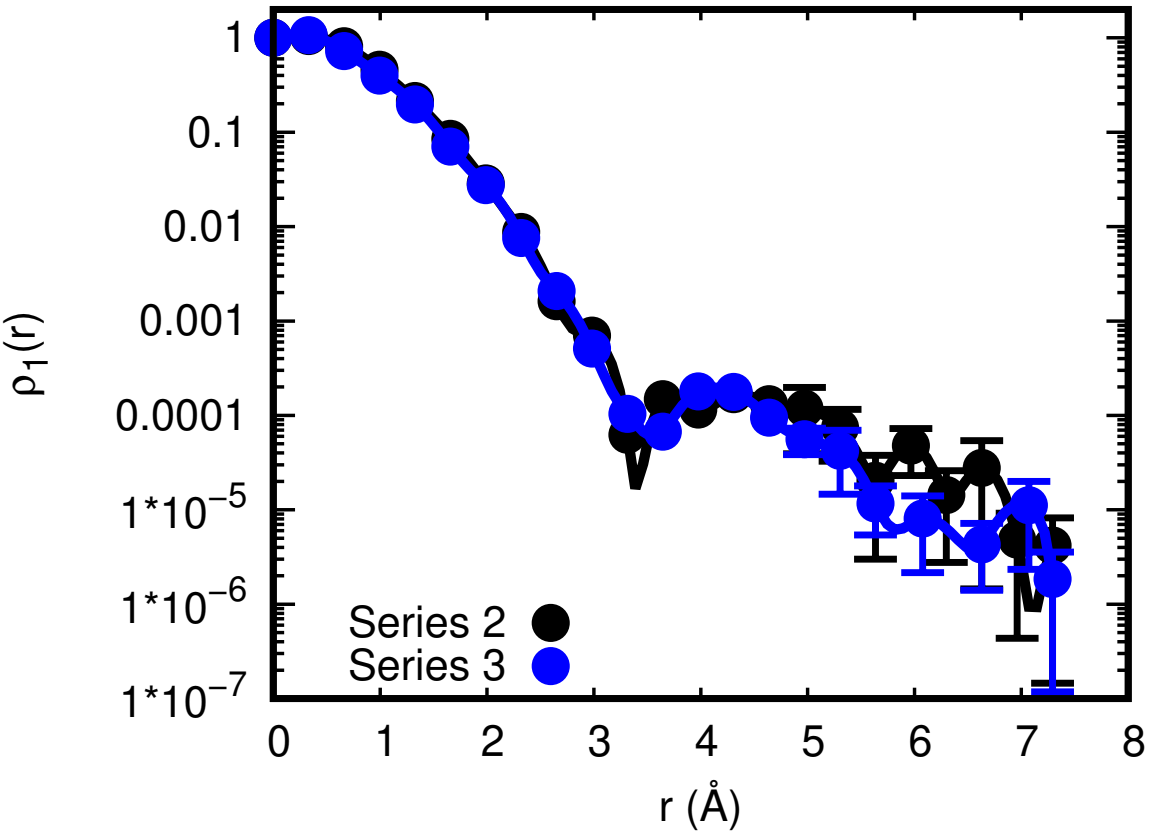
Abstract

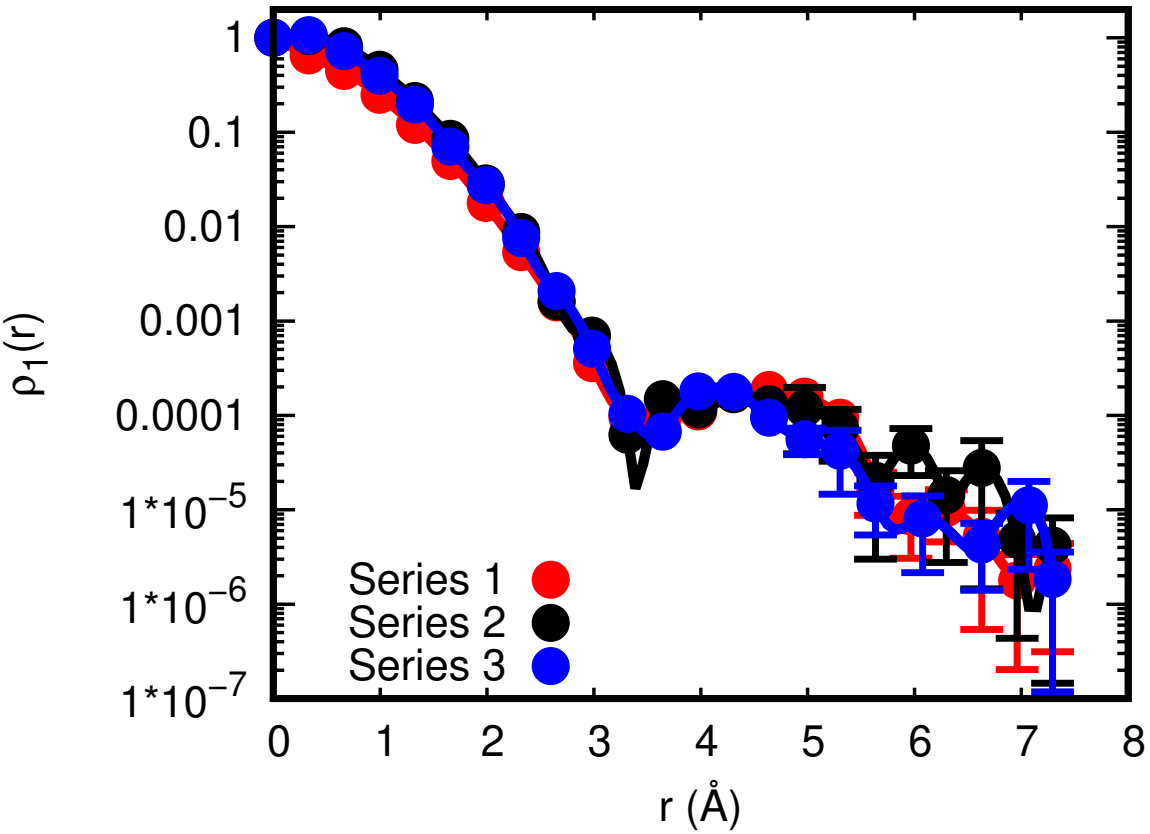
In this Supplemental Material document, we provide the results of several technical tests performed on the convergence of the one-body density matrix function, ρ_1, calculated at zero temperature with the path-integral Monte Carlo (PIGS) method. In particular, we provide explicit comparison between several ρ_1 results obtained by using different numbers of time slices (or "beads"), M, and imaginary time steps, τ. Overall, the results of our technical tests demonstrate that the ρ_1 values enclosed in Figure 2 of the main text are well-converged with respect to the technical parameters M and τ.



Supplementary Figure 1: PIGS one-body density matrix results obtained at zero temperature for hcp ^{4}He containing an edge dislocation with the Burgers vector oriented along the c-axis (CE). The y-axis is in logarithmic scale. The number of times slices and imaginary time step employed in "Series 1" are $M = 25$ and $\tau = 0.0125$ K^{-1} while in "Series 2" are $M = 40$ and $\tau = 0.0125$ K^{-1}. The ρ_1 results obtained in both series are consistent with each other within their statistical errors thus the ρ_1 results enclosed in Figure 2 of the main text (corresponding to "Series 1") are demonstrated to be well-converged with respect to the technical parameter M. In all the cases, an exponential ρ_1 decay is observed at long distances.



Supplementary Figure 2: PIGS one-body density matrix results obtained at zero temperature for hcp ^{4}He containing an edge dislocation with the Burgers vector oriented along the c-axis (CE). The y-axis is in logarithmic scale. The number of times slices and imaginary time step employed in "Series 2" are $M = 40$ and $\tau = 0.0125$ K^{-1} while in "Series 3" are $M = 40$ and $\tau = 0.00625$ K^{-1}. The ρ_1 results obtained in the two series are consistent with each other within their statistical errors thus the ρ_1 results enclosed in Figure 2 of the main text (obtained with $\tau = 0.0125$ K^{-1}) are demonstrated to be well-converged with respect to the technical parameter τ. In all the cases, an exponential ρ_1 decay is observed at long distances.



Supplementary Figure 3: PIGS one-body density matrix results obtained at zero temperature for hcp ^{4}He containing an edge dislocation with the Burgers vector oriented along the c-axis (CE). The y-axis is in logarithmic scale. The number of times slices and imaginary time step employed in "Series 1" are $M = 25$ and $\tau = 0.0125$ K^{-1} while in "Series 2" are $M = 40$ and $\tau = 0.0125$ K^{-1} and in "Series 3" are $M = 40$ and $\tau = 0.00625$ K^{-1}. The ρ_1 results obtained in all the series are consistent with each other within their statistical errors thus the ρ_1 results enclosed in Figure 2 of the main text (corresponding to "Series 1") are demonstrated to be well-converged with respect to both technical parameters M and τ. In all the cases, an exponential ρ_1 decay is observed at long distances.

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