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Physica A 216 (1995) 195

PHYSICA A

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Comment

# Comment on "Two disks in a box" [R.J. Speedy, Physica A 210 (1994) 341]

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Received 1 November 1994

In contradiction to the widely-held view that phase transformations can only be associated with *infinite* systems, Speedy [1] showed that the partition function for a periodic *two*-disk system has a van der Waals' loop resembling, qualitatively, that found by Alder and Wainwright in their investigations of the melting-freezing transitions of hard disks and spheres some thirty years ago [2]. This analog, as well as its extension to nonsingular repulsive potentials, has been noted before. In 1963, Alder, Hoover and Wainwright [3] called attention to the van der Waals behavior of two hard disks, using periodic boundary conditions suited to the close-packed triangular lattice. Compare the figure in Ref. [3] with Speedy's Fig. 1. It was pointed out in Ref. [3] that the pressure and density for the two-body transition lie within 10% of those estimated for hard disks in the thermodynamic limit [4]. Similar analytic results were pointed out for periodic systems of a few hard squares [5].

## References

[1] R.J. Speedy, Two disks in a box, Physica A 210 (1994) 341.

[2] See, for instance, the discussion in Chapter 6 in: W.G. Hoover, Computational Statistical Mechanics (Elsevier, Amsterdam, 1991).

[3] B.J. Alder, W.G. Hoover and T.E. Wainwright, Cooperative motion of hard disks leading to melting, Phys. Rev. Lett. 11 (1963) 241.

[4] W.G. Hoover and F.H. Ree, Melting transition and communal entropy for hard spheres, J. Chem. Phys. 49 (1968) 3609.

[5] W.G. Hoover and B.J. Alder, Studies in molecular dynamics. IV. The pressure, collision rate, and their number dependence for hard disks, J. Chem. Phys. 46 (1967) 686.

Elsevier Science B.V.
*SSDI* 0378-4371(95)00008-9