# Melting of the two-dimensional solid phase in the Gaussian-core model

Alejandro Mendoza-Coto[1], Valéria Mattiello[1], Rômulo Cenci[1], Nicolò Defenu[2], Lucas Nicolao[1]

[1] Departamento de Física, Universidade Federal de Santa Catarina,
[2] Institut für Theoretische Physik, Eidgeössische Technische Hochschule Zürich

A general theory for the melting of two dimensional solids explaining the universal and non-universal properties is an open problem up to date. Although the celebrated KTHNY theory have been able to predict the critical properties of the melting transition in a variety cases, it is already known that it is not able to capture the occurrence of first order transitions observed in certain systems as well as it doesn't provide a clear way to calculate the melting temperature for a specific model. In the present work (Phys. Rev. B 109, 064101) we have developed an analytical method that combines Self Consistent Variational Approximation with the Renormalization Group in order to deal simultaneously with the phonon fluctuations and the topological defects present in the melting process of two dimensional crystals. The method was applied with impressive success to the study of the phase diagram of the Gaussian-core model, capturing not only the reentrant feature of its 2D solid phase, but also the related critical temperatures as a function of the density in quantitative detail. The developed method can be directly applied to study the melting of any hexagonal simple crystal formed by particles interacting through any finite pairwise interaction potential. Additionally, it has the potential to explain the occurrence of first order transitions in the melting process of two dimensional crystals.

## Type

ORAL