

**UNIVERSITY OF CALIFORNIA, DAVIS**  
**DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING**

Nov 1, 2021

Dear Prof. Jaeger,

I would like to submit an original research article entitled “Quotient Maps and Configuration Spaces of Hard Disks” to be considered for publication in *Granular Matter*.

The manuscript investigates the topological and geometric properties of the configuration spaces of hard disks, and particularly the effect of quotienting the space by the action of symmetry groups. A Morse theoretic approach is used to find the critical points (the regions where the topology changes) and to analyze the underlying manifolds. While it is widely assumed that the properties and behavior of the critical points are preserved when quotienting by symmetries, we observed that the number and behavior of the critical points can be dramatically affected. This suggests that certain widespread practices, e.g., quotienting the configuration space of a thermodynamic system by permutations of particle labels, be examined in more detail. The eventual intention is to use this as a model system to study the origins of phase transitions in other systems.

This study is carried out by myself, Ozan Burak Eriçok, under the supervision of Prof. Jeremy Mason. I confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere. We believe that this manuscript fits under the category of Statistical Physics in *Granular Matter*. We have no conflicts of interest to disclose.

Thank you for your consideration of our manuscript.

Sincerely,



Ozan Burak Eriçok  
Ph.D. Candidate  
Department of Materials Science and Engineering  
University of California, Davis  
95616, CA, USA  
Ph: +1 530 219 3729