Abstract Submitted
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Thinking Inside the Box: The Optimal Filling of Shapes[1] CAROLYN PHILLIPS, Argonne National Laboratory, JOSHUA ANDERSAON, University of Michigan, GREG HUBER, University of California, Santa Barbara, SHARON GLOTZER, University of Michigan — We introduce a new spatial partitioning problem called filling[1,2], which combines aspects of traditional packing and covering problems from mathematical physics. Filling involves the optimal placement of overlapping objects lying entirely inside an arbitrary shape so as to cover the most interior volume. In n-dimensional space, if the objects are polydisperse n-balls, we show that solutions correspond to sets of maximal n-balls. We investigate the mathematical space of filling solutions and provide a heuristic for finding the optimal filling solutions for polygons filled with disks of varying radii. We consider the properties of ideal distributions of N disks as N approaches infinity. We discuss applications of filling to such problems as tumor irradiation, designing wave fronts and wireless networks, minimal information representations of complex shapes, and molecular modeling of nanoparticles and colloids.

[1] Phillips, Anderson, Huber, Glotzer, The Optimal Filling of Shapes, PRL 108, 198304, 2012
[2] Phillips, Anderson, Huber, Glotzer, Optimal Fillings - A new subdivision problem related to packing and covering, arXiv:1208.5752, 2012

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