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Dissertation Defense  
  
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Abstract:

Due to the phenomenon of gravitational lensing, light from distant sources may appear as several images. The ``image counting problem from gravitational lensing'' refers to the question of how many images might occur, given a particular distribution of lensing masses. A common model treats the lensing masses as a finite collection of points situated in a finite collection of planes. The position of the apparent images correspond to the critical points of a real-valued function and also as solutions to a system of complex rational equations. Herein, we give upper bounds for the number of images in a point mass multiplane ensemble with an arbitrary number of masses in an arbitrary number of planes. We give lower bounds on the number of solutions in a closely related problem concerning gravitational equilibria. We use persistence homology to investigate two different stochastic ensembles. Finally we produce a multiplane ensemble, related to the maximal one plane ensemble, that produces a large number of images.