

## A Meinardus theorem with multiple singularities

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### Abstract

This is a joint work with Dudley Stark (London). Meinardus proved a general theorem about the asymptotics of the number of weighted partitions, when the Dirichlet generating function for weights has a single pole on the positive real axis. Continuing our paper in *Adv. Appl. Math.*, v.41,3(2008), we derive asymptotics for the numbers  $c_n$  of three basic types of decomposable combinatorial structures (or, equivalently, ideal gas models in statistical mechanics) of size  $n$ , when their Dirichlet generating functions for weights have multiple simple poles on the positive real axis. Examples to which our theorem applies include ones related to vector partitions and quantum field theory. Our asymptotic formula for the number of weighted partitions disproves the belief accepted in the physics literature that the main term in the asymptotics of  $c_n$  is determined by the rightmost pole. Our asymptotic analysis is based on a combination of Khintchine probabilistic representation for  $c_n$  and Meinardus' approach to asymptotic enumeration. The most difficult part of the analysis is the asymptotic formula for the free parameter in the case of many poles.

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