Application ASEP2D

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Complex Systems:

Emergence of collective properties in systems with many interactive components, i.e. quarks, atoms, proteins, bacteria, but also people and institutions

Reductionism (20th century): elementary constituents (bricks). It tries to explain how each of the bits work.

But...

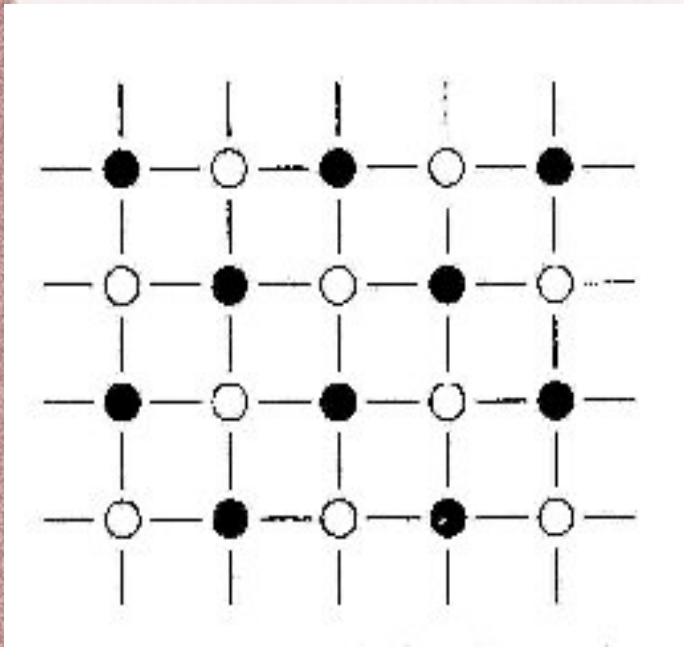
If you try to take a cat apart to see how it works, the first thing you have in your hands is a non-working cat.

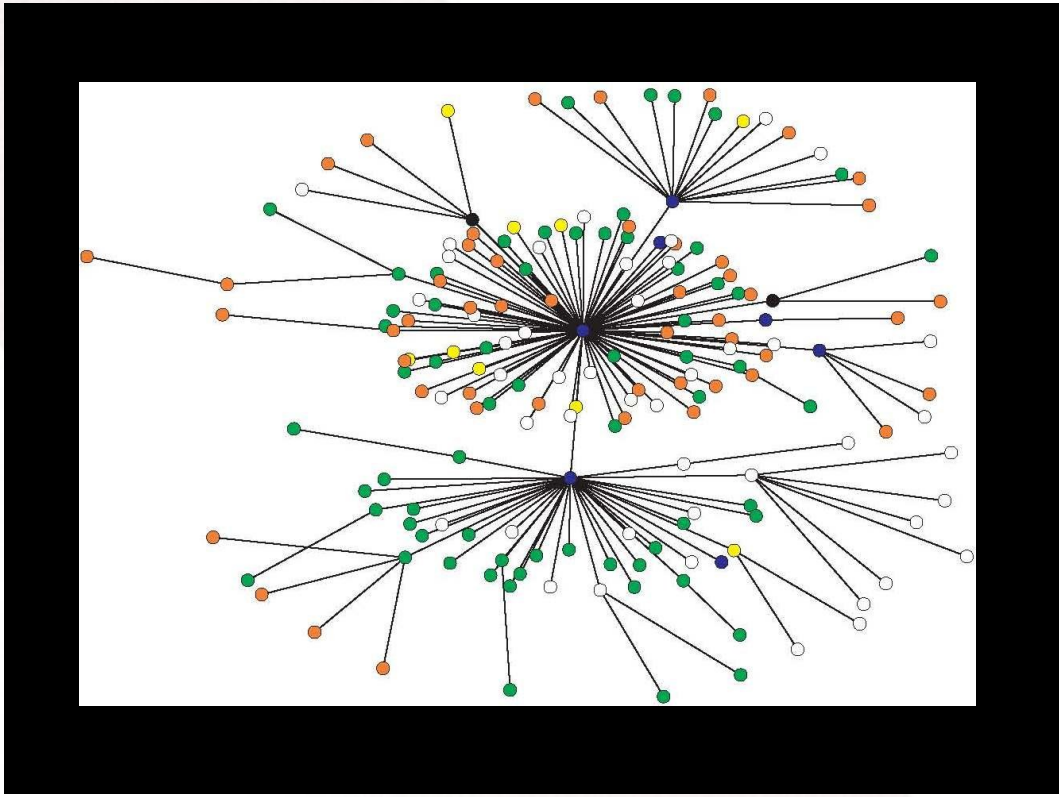
Douglas Adams, 1998

Complexity is a relatively new approach to science which complements reductionism. It tries to explain how the bits all work with one-another.

The role of statistical physicist

The statistical physicists use “their box of tools” to try to foresee the final state of systems with given rules of interaction and topology.





Reaction-diffusion of pollutants in soils

Have experimental results, obtained from measurements of concentrations in a column.

Theoretical eqns do NOT explain experimental curves.

Simple model:

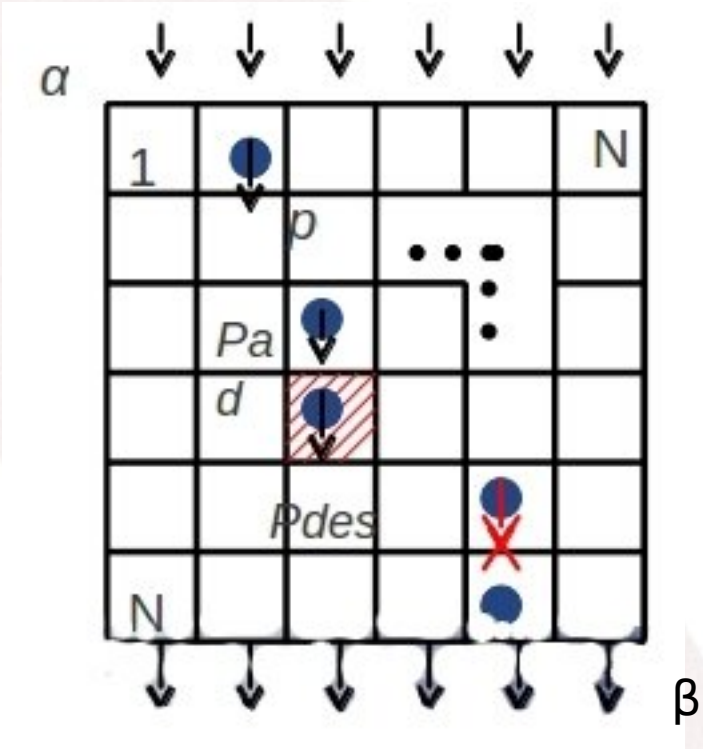
Square lattice

Particles introduced at rate α

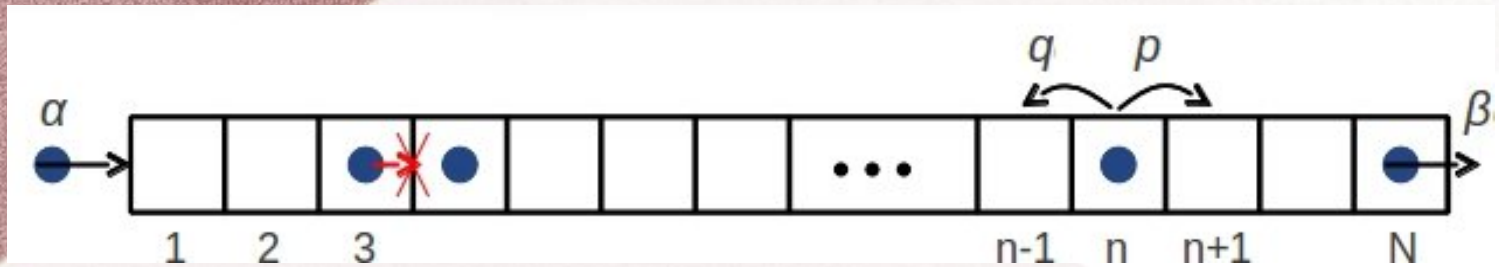
Jump at rate p

Adsorbed/desorbed

Exit at rate β



Asymmetric Exclusion Process (ASEP)



Used for modelling:

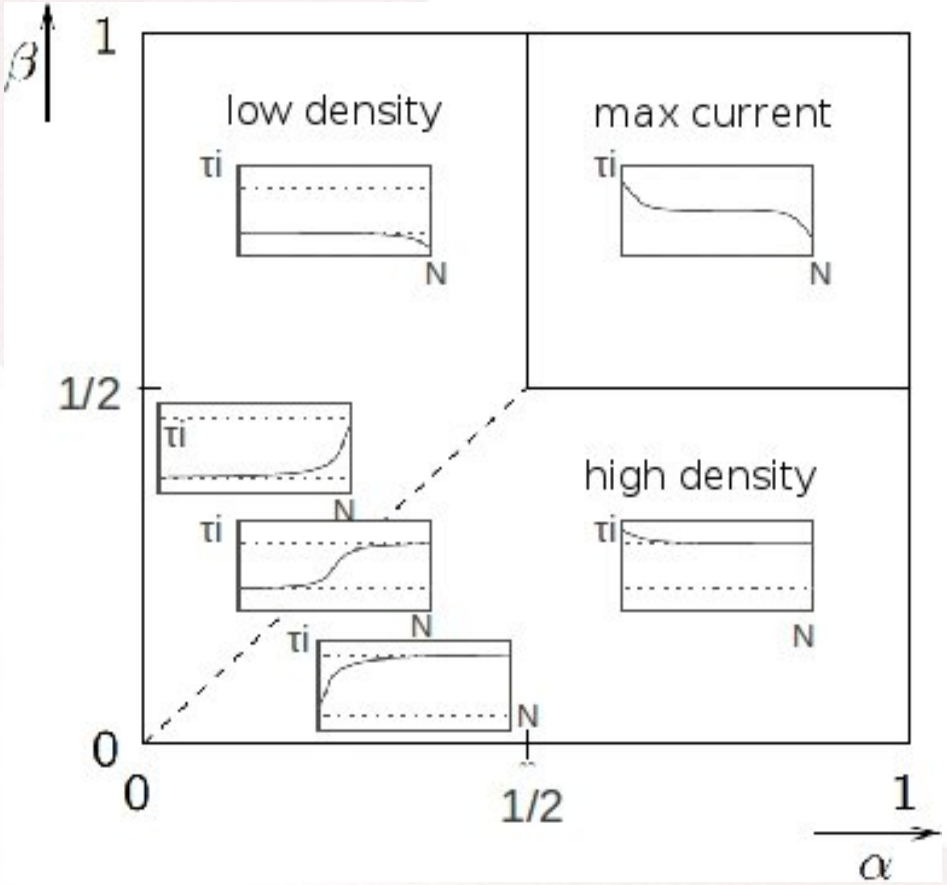
processes in cells

ATP-ase

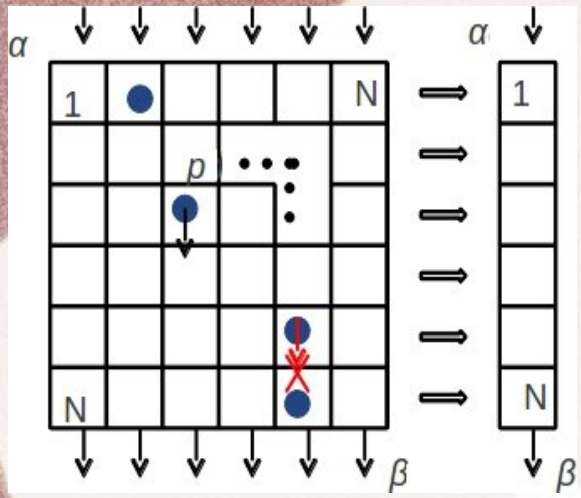
Brownian motors

growth processes

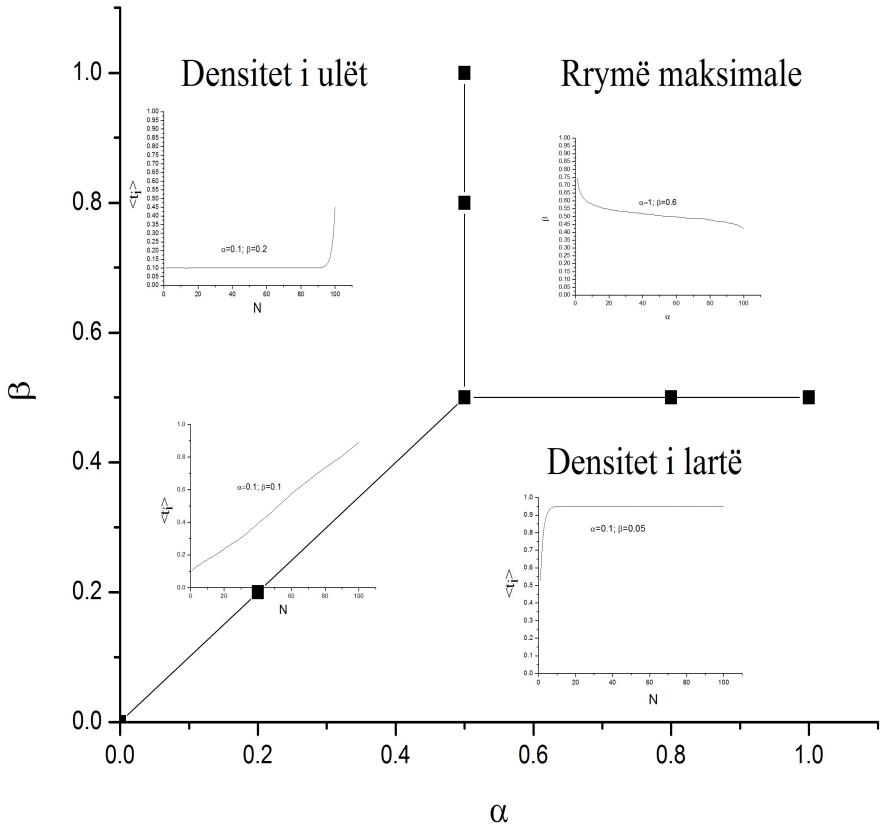
traffic jams, etc.



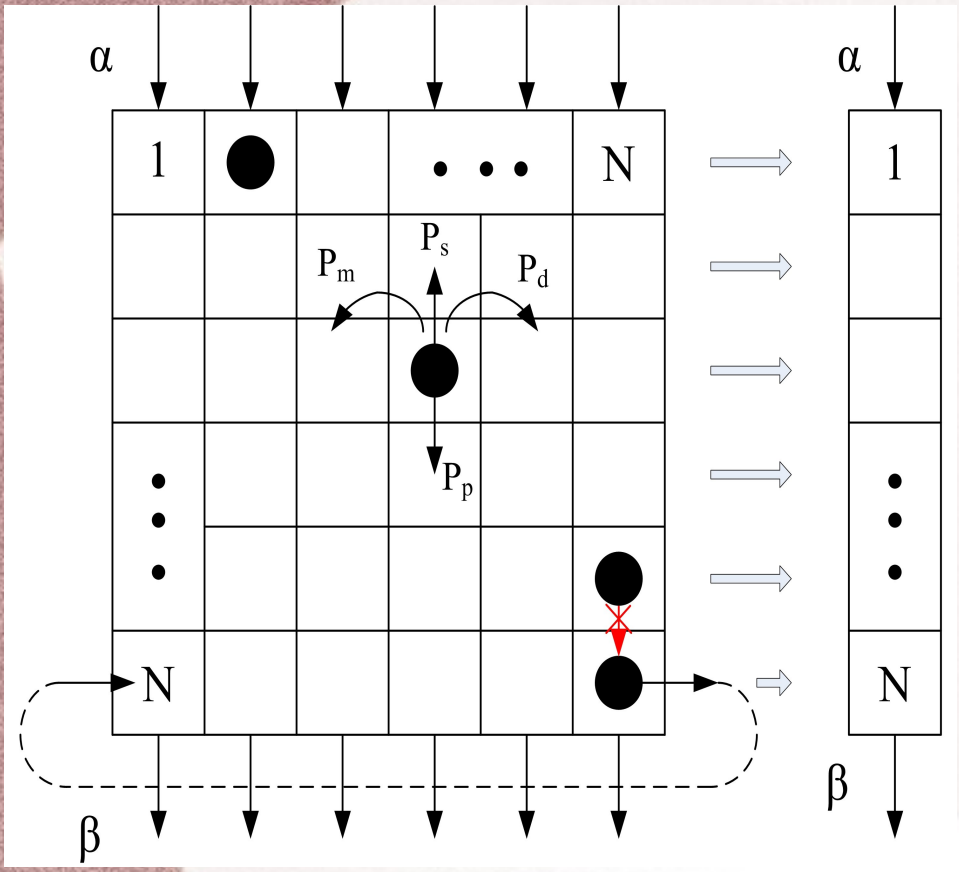
Mapping our model into ASEP



Same phase diagram as ASEP1D!



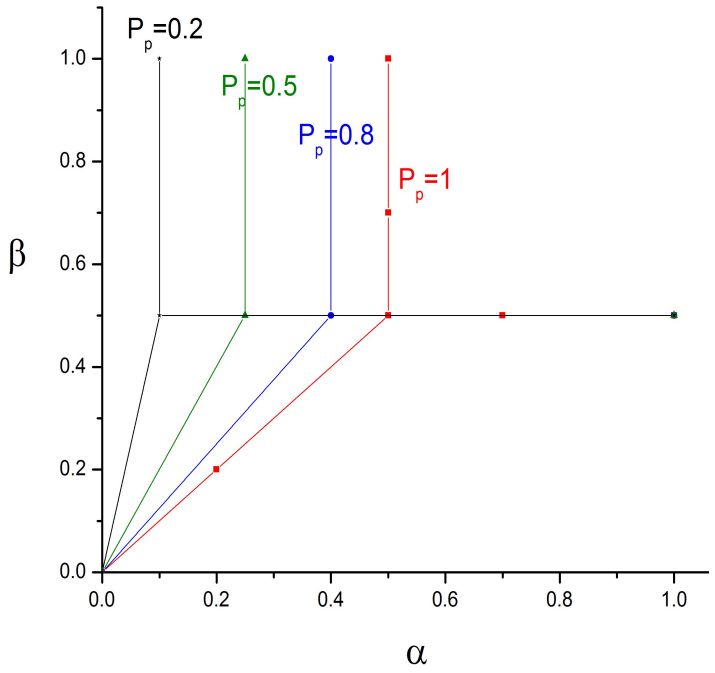
Asymmetric exclusion process in 2D

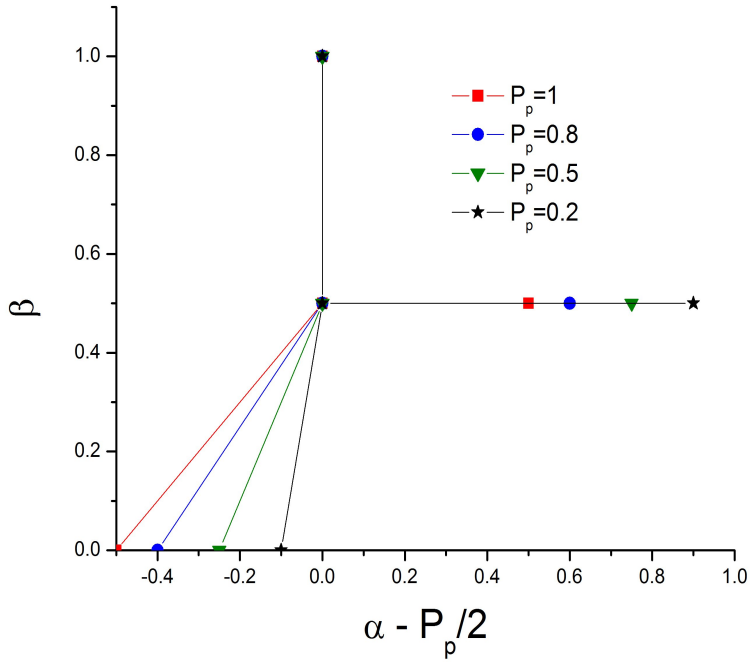


Particles can jump up, down, left, right at given rates (diffusion+gravity present)

Expect modifications of phase diagram as opposed to 1D

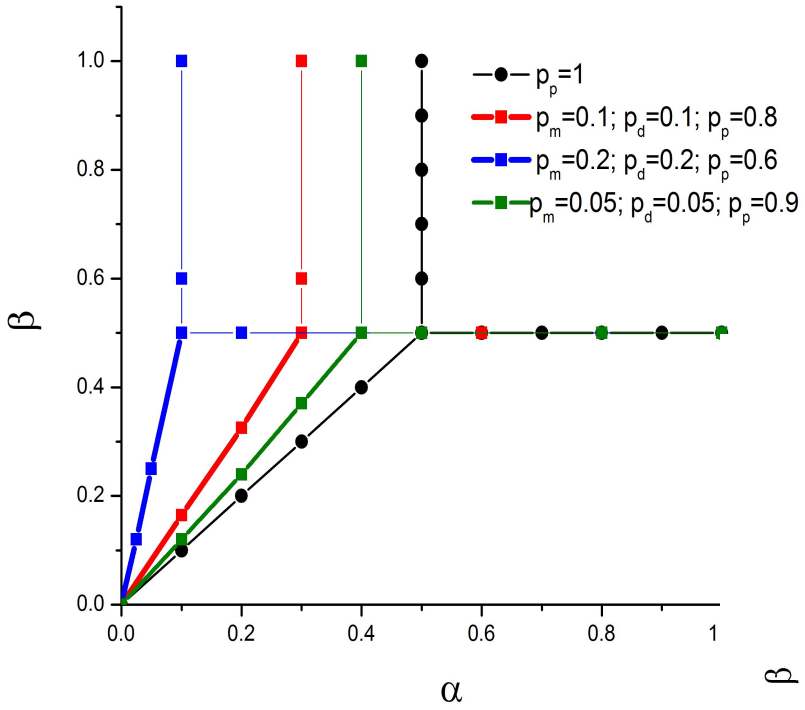
Phase diagram for different jump rates

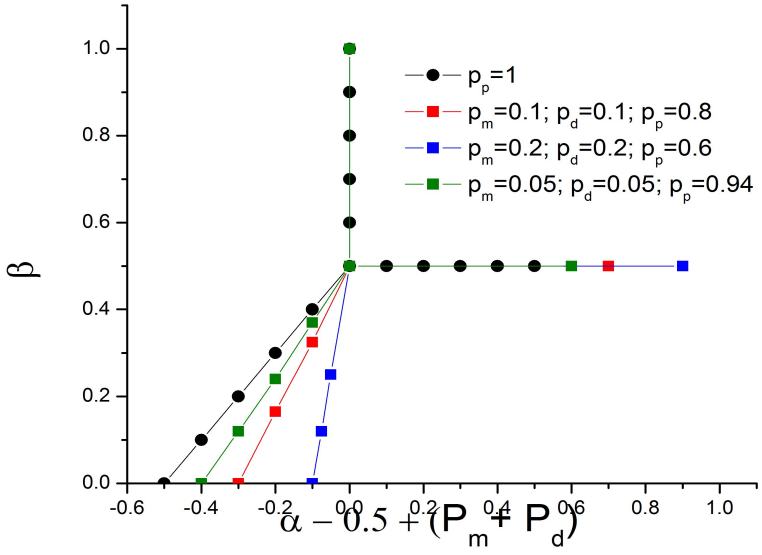




Triple point moves

Phase diagram for different jump rates





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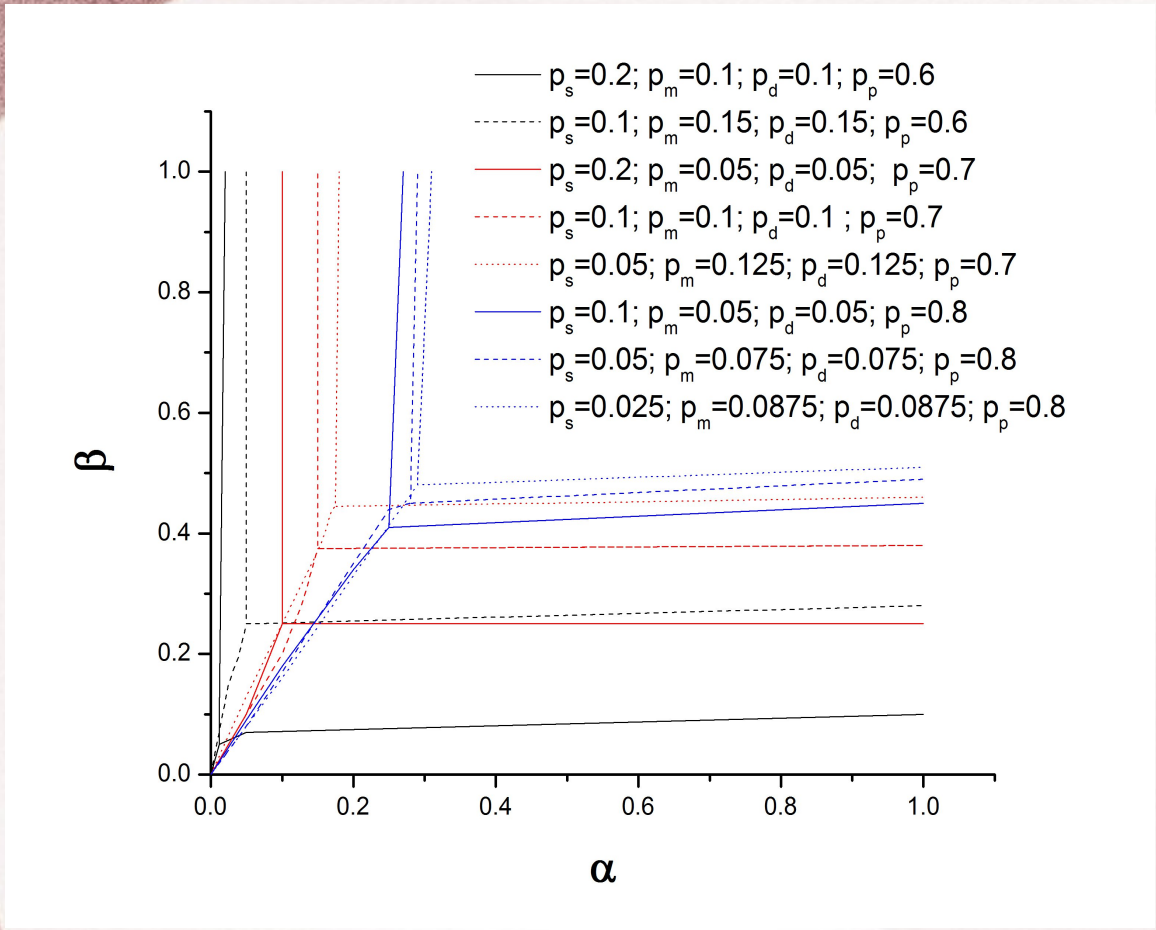

Need to see how it scales with system size

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