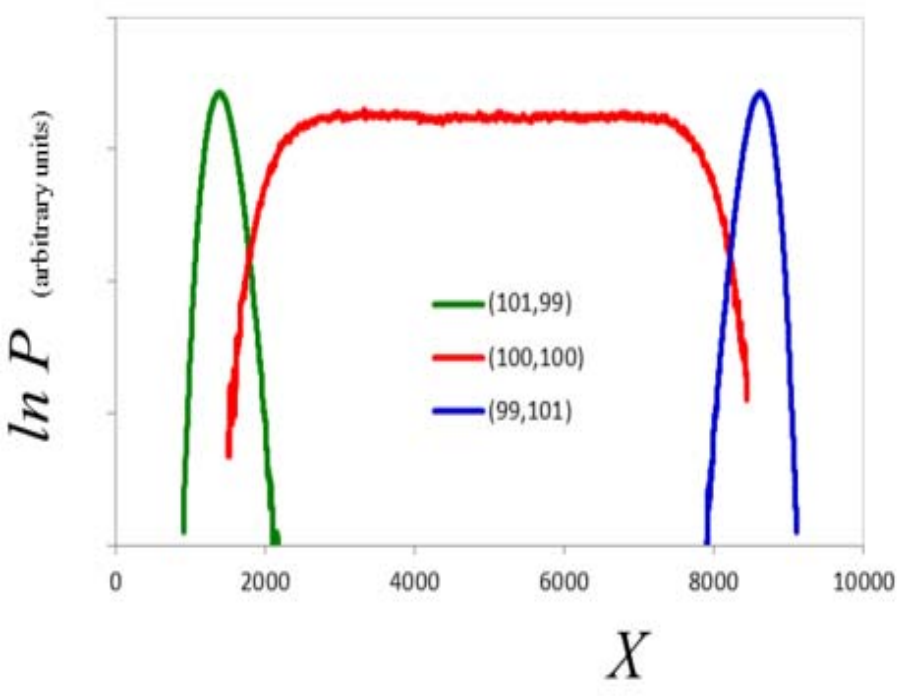
Statistical Mechanics of Systems far from Equilibrium

Beate Schmittmann and Royce K.P. Zia
Iowa State University DMR-1244666

Interacting networks or communities characterize many biological and social systems. Links between nodes or members can evolve dynamically, according to the preferences of each group. In a preferred degree network, members of a given group all prefer to have a preset number of connections – few (many) if the members are introverts (extroverts). Members add or remove links randomly, depending on whether they have too few or too many. In the extreme case in which introverts do not want to connect at all while extroverts want to connect to everybody, the number of crosslinks, X, between introverts I and extroverts E develops surprising features. If the two groups differ in size, i.e., $N_I \neq N_E$, X settles quickly on a sharply defined average and exhibits only small fluctuations around it.

However, when the two communities are of equal size, $N_I = N_E$, X exhibits large fluctuations and can drift over a wide range of values. The transition between the two behaviors is remarkably sharp, as illustrated by the histogram below for three choices of (N_I, N_E).



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In support of NSF's mission to educate and mentor junior scientists, we have worked closely with students from freshman to PhD level, as well as postdocs and alumni in all research settings. We are also keenly aware of the need to attract women and other underrepresented groups to physics and always seek new ways to engage them. The photo shows the PI with a group of young women at a recent *Conference for Undergraduate Women in Physics*.