Systems with a strong interaction to an environment

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1 Transitions in the P(s)

We are interested in finding the transitions of from a GOE to Poisson statistics on the nearest neighbor distribution ($P(s)$) when the parameters change from the ergodic regime to the non-ergodic one.

Spectra was obtained with two different methods, in the first one we break the symmetry by varying the Ising interaction between the spins on the closed chain. For the second one we decomposed the open chain into reflection symmetry sectors.

Animations of the $P(s)$ for a chain in the two cases varying different components of the magnetic kick. As the color lines in the Fig. 1 shows.
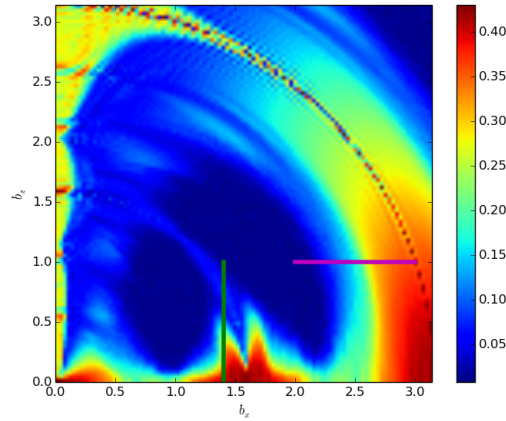

Figure 1

The animations are ass follows

- "Ps _transition1" - Closed chain $J = 1$ $b_x = [2, 3]$ $b_z = 1$. $\Delta J = 0.1$ *

- "Ps _transition1_sym" - Open chain $J = 1$ $b_x = [2, 3]$ $b_z = 1$. reflection symmetries used *

- "Ps _transition2" - Closed chain $J = 1$ $b_x = 1.4$ $b_z = [0, 1]$ $\Delta J = 0.1$ *

- "Ps _transition2_sym" - Closed chain $J = 1$ $b_x = 1.4$ $b_z = [0, 1]$ reflection symmetries used *

Comparin the two methods we see that breaking symmetries using small variations in the Ising interaction in the chain gives a better shaped $P(s)$. Also the transitions shows some correlation with the map 1 only in some places of the regime, this remains a mystery

2 Purity decay

We start by studying "model3" and "model4" (see "models.cu"). Our first analysis is made with the parameters that make both systems A and B ergodic. The parameters are $[J_c, J_p, J_s, \Delta J, \Delta b, b_x, b_z]$
Where:

- J_c - Interaction of C with A.

- J_p - Interaction between A and B.

- J_s - Center of internal interactions of A and B.

- ΔJ - Such that $J_i \in [J_s - \Delta J, J_s + \Delta J]$.

- Δb - Such that $b_{\{x,z\}_i} \in [b_{\{}x,z\} - \Delta b, b_{\{}x,z\} + \Delta b]$.

- b_x - Center of magnetic component x.

- b_z - Center of magnetic component z.

We fix all parameters except J_p and we calculate an average of the purity defined as:

$$< \gamma >_{T_1}^{T_2} = \frac{1}{T_2 - T_1 + 1} \sum_{t=T_1}^{T_2} \gamma(t). \tag{1}$$

For $< \gamma >_{80}^{100}$ using the parameters $J_c, J_p, J_s, \Delta J, \Delta b, b_x, b_z = [0.05, 0., 1.0, 0.1, 0, 1.0, 1.0]$ and $J_p \in [0, 2\pi]$. For the "model3 _open" we obtain
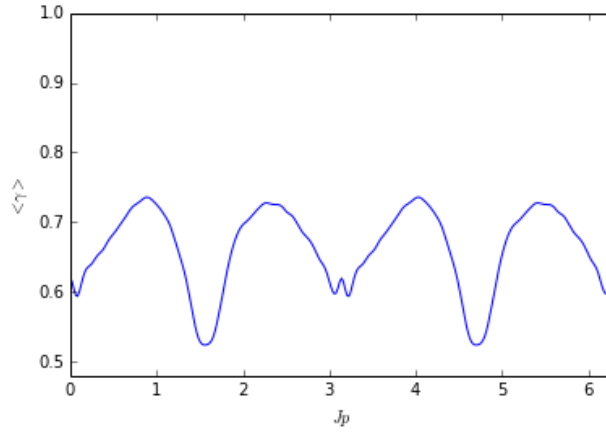

Figure 2

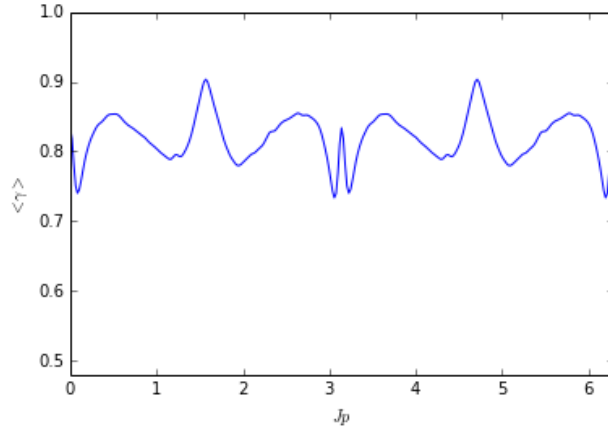With the same parameters for "model4 _open"

Figure 3

Something very important is noted between these two figures. In Fig. 2 we see the maximum of $< \gamma >$ around the value $J_p = 1.0$ which is almost equivalent as one central system connected to a large system, as A and B merge into one big chain. In Fig. 3 we see however that is not the case and one can achieve very high values of $< \gamma >$ for a certain small value of J_p.