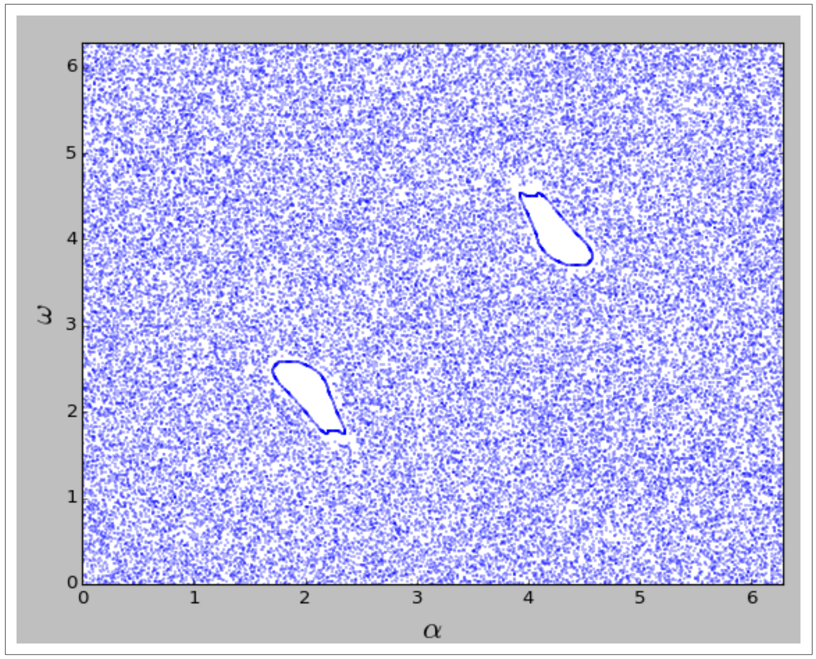
Ehsan Kourkchi … HW06

K = 5
α0 in [0:1]
ω0 in [0:2π]

In the previous assignment, we used the above values to avoid the integrable solutions.

Therefore, we use the same domain to do the current assignment.

The number of simulated systems: **100,000** with different initial conditions.



Codes:
1) `ehsan.hw06.py`

```
It calculates the final
energy of 100,000 kicked
rotators after 2,000 steps,
and save in an output file
(i.e. energies.v2.txt). This
process takes time, that's
why having an output file
seems to be necessary.
```

2) `ehsan.hist.py`

```
Using the set of energies for
different systems, we
construct their energy
distribution and study how
the tail of the distribution
goes to zero.
```

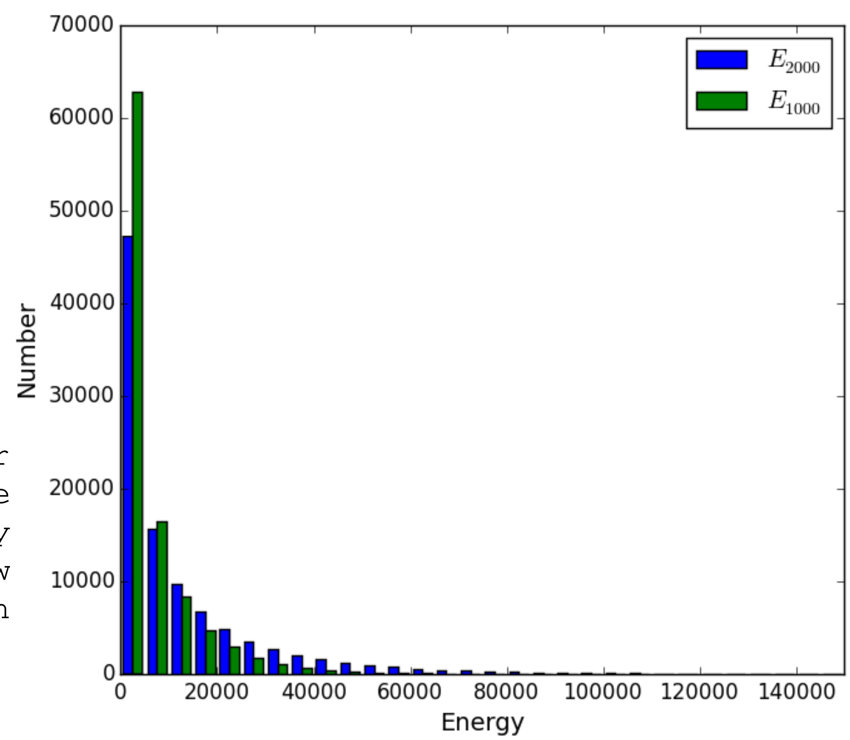


Fig 1: The energy distribution. E2000 is the enrgy of the system at step 2,000, and E1000 at step 1,000.

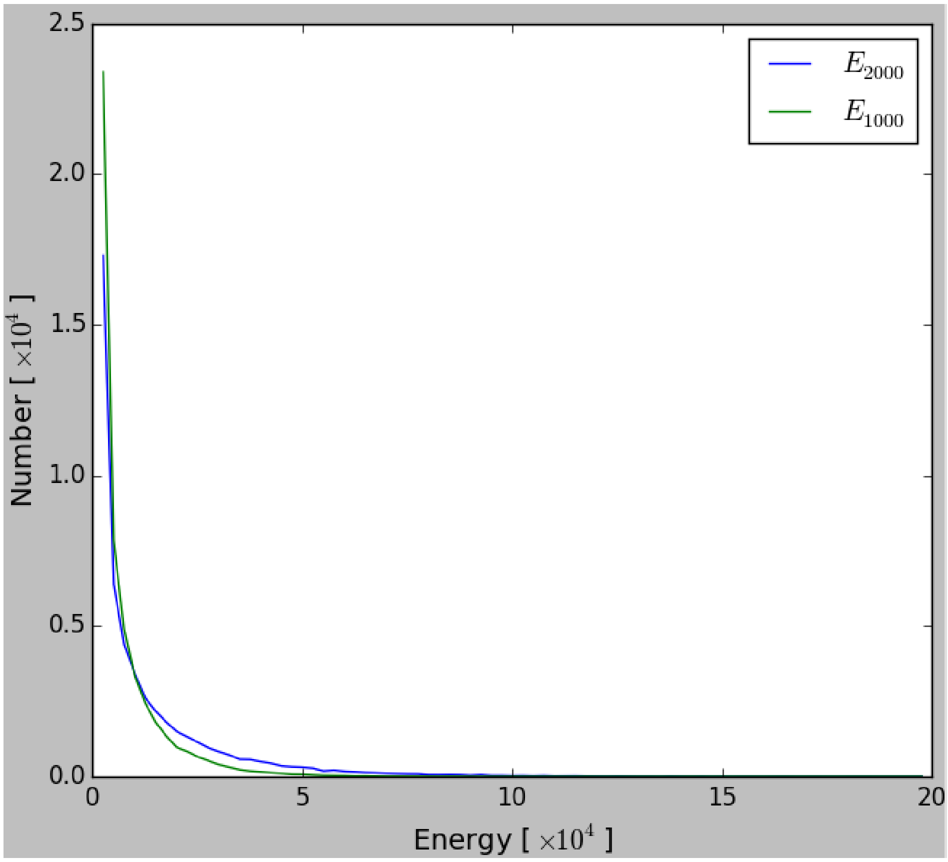


Fig 2: Energy distribution, Linear-Linear

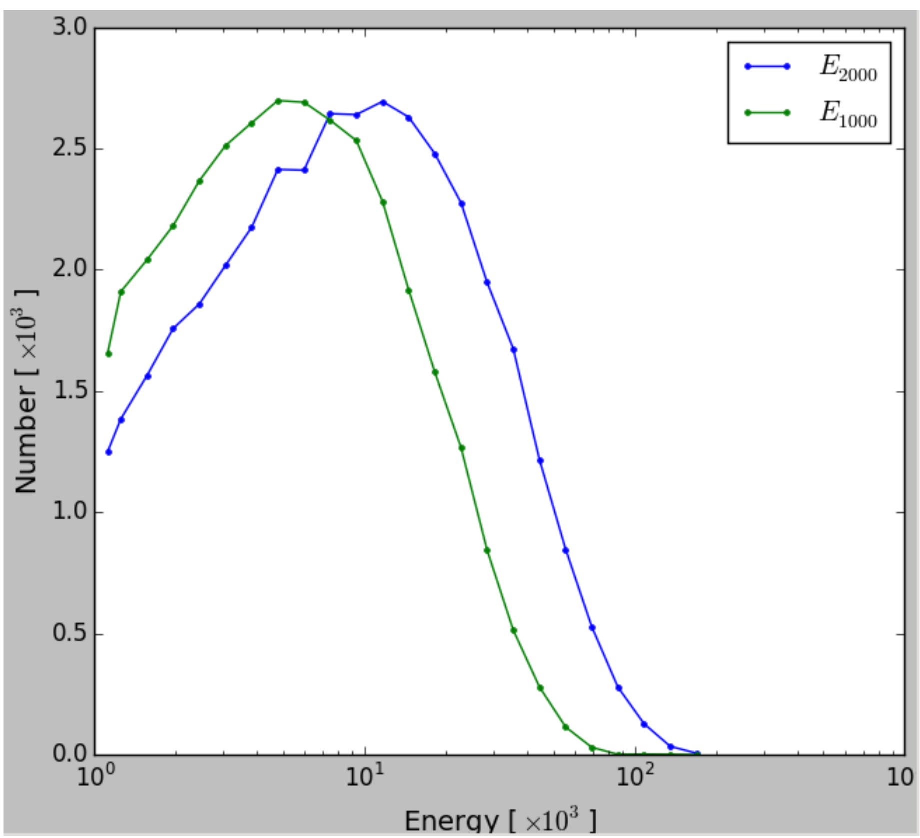


Fig 3: Energy distribution, the energy axis is in logarithmic scale (Log-Linear)

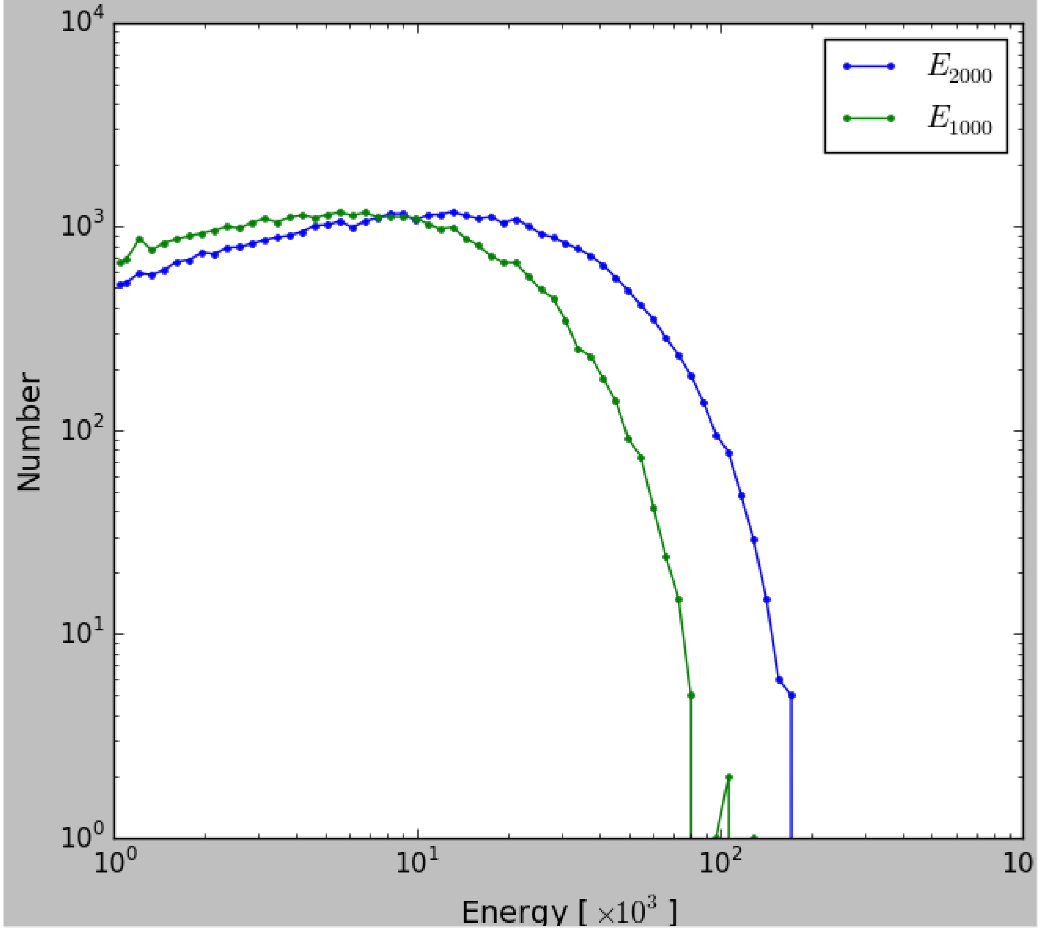


Fig 4: Energy distribution, Log-Log scale

So if the tail of the distribution follows a polynomial function, then we should see a linear behavior of tail at log-log plot.

$P(E) \propto E^{-\alpha}$
$\rightarrow \log(P) = (-\alpha) \log(E) + cte.$

$\rightarrow$ if set $\log(P) = Y$ and $\log(E) = X$ then
$Y = -\alpha X + cte.$

Since, plot 4 does not show any linear behavior f the tail, w cannot fit a line and find α

Then we look at linear-log plot of P(E):

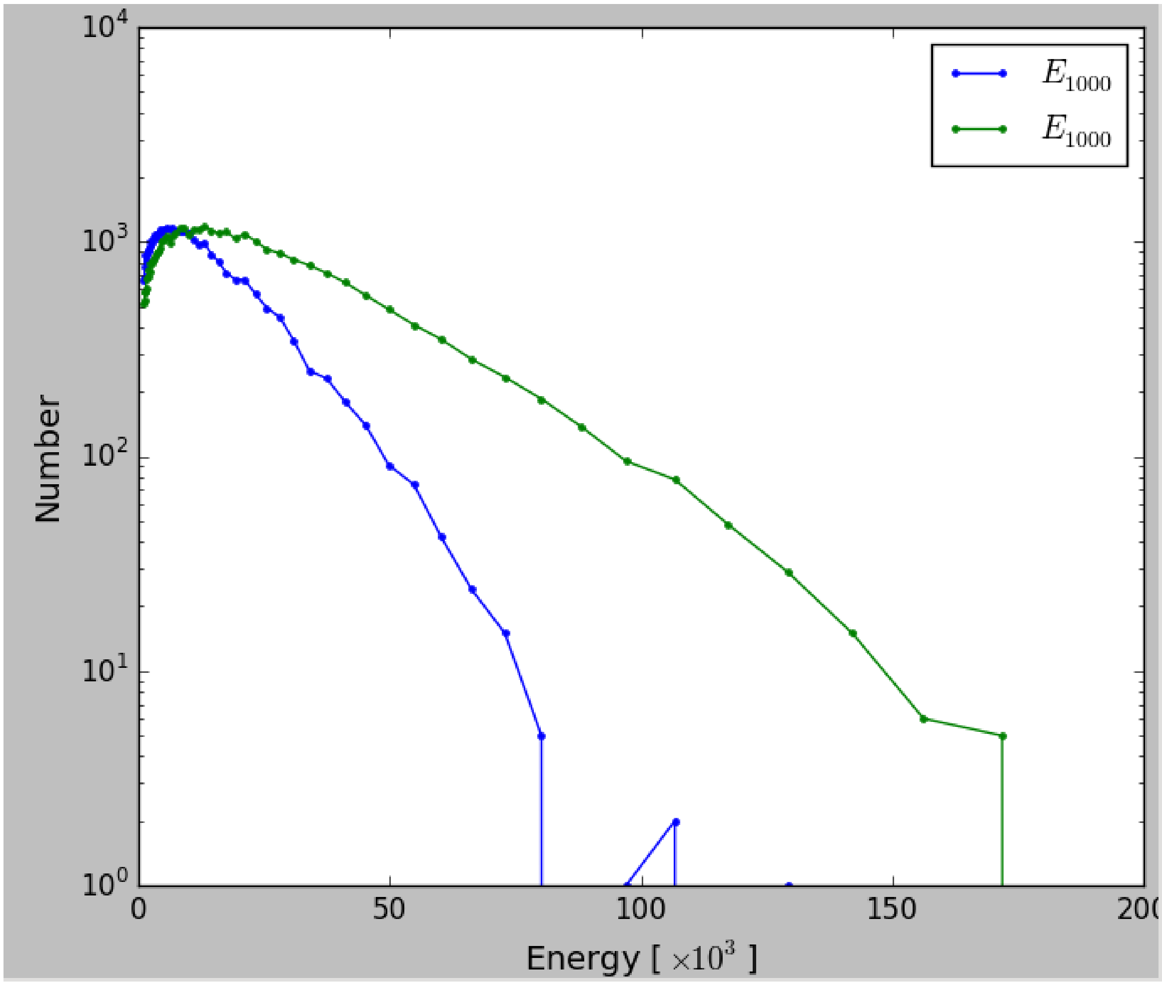


Fig 5: Energy Distribution, the number axis (Y-axis) is in logarithmic scale .. Linear-Log

P(E) ∝ exp(-E/Es)
→ log(P) = (-E/Es) log(e) + cte.

→ if set log(P) = Y then
Y = (-E/Es) log(e) + cte.

According to plot 5, Y has a linear relation with E, at the tail of energy distribution. Therefore, we can find the coefficient of the best fitted line, and calculate Es.

The red point in plots 6 and 7, are those point used for the line fitting.

Fig 6: 100,000 initial conditions

Green curve:

Es = 28.34

Running the system for 2,000 steps

Blue Curve:

Es = 15.24

Running the system for 1,000 steps

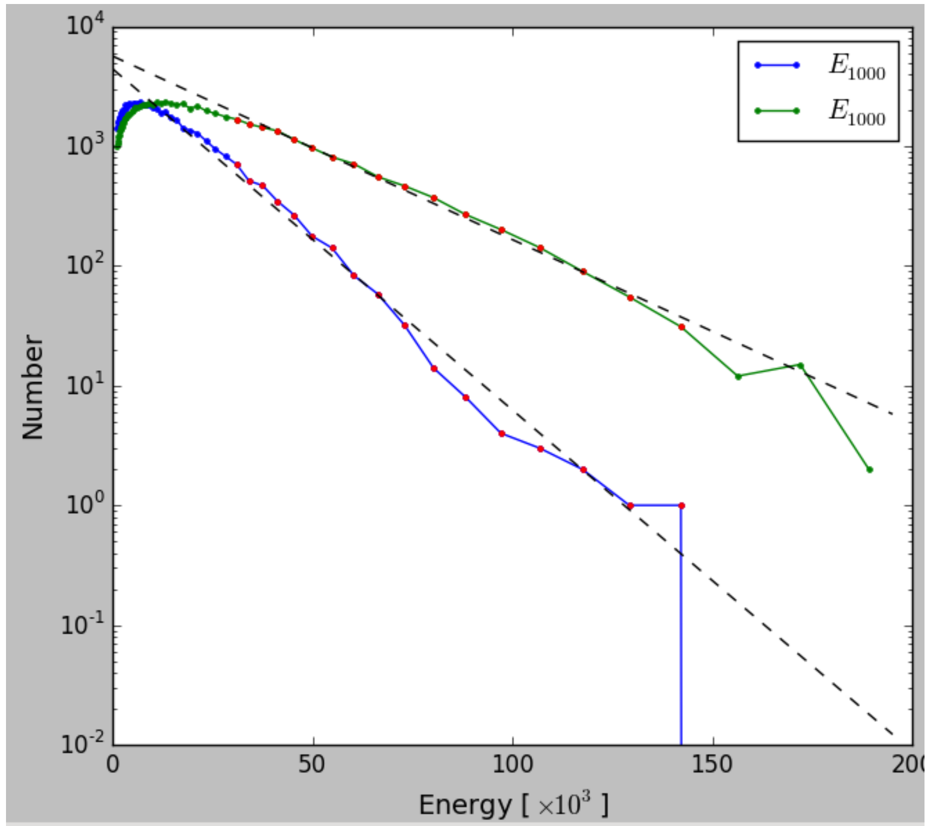


Fig 6: Same as Fig 5, fitting straight lines on the tails

Fig 7: 50,000 initial conditions

Green curve:

Es = 28.64

Running the system for 2,000 steps

Comparing plot 6 and 7 shows that changing the sample size does not significantly change the resulting fitted line and therefore the estimated Es.

However, I don't still understand, why the line slope is different when we look at systems at different steps. And the remaining questions is that, how many steps, we need to run the rotators in order to fully constrain Es.

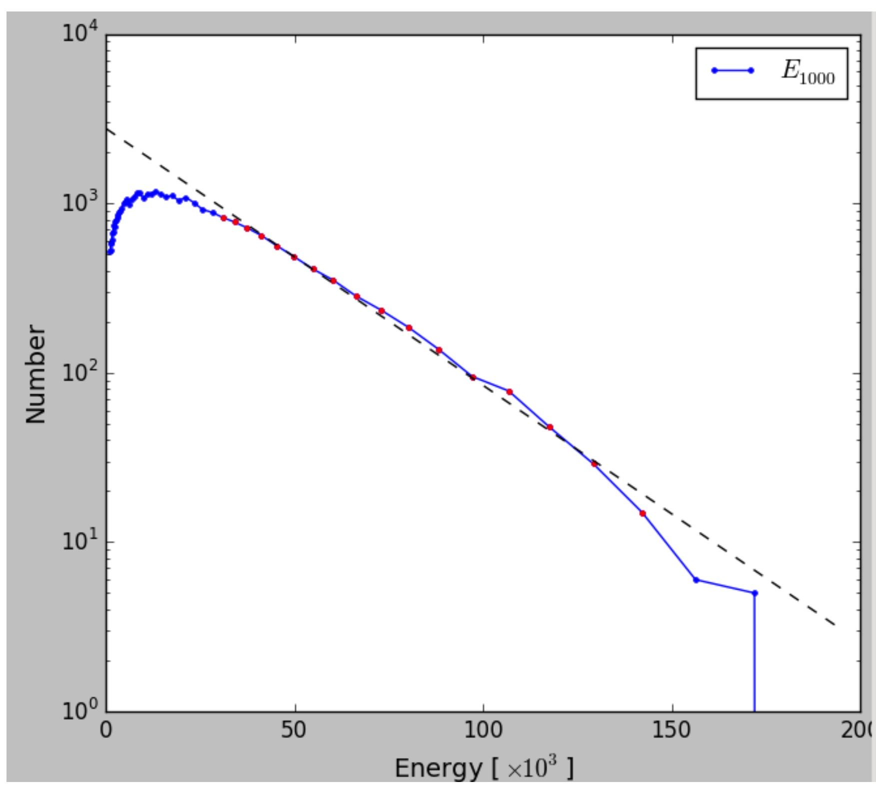


Fig 7: energy distribution, for a set with 50,000 members