1 Metropolis Hasting algorithm in phase space:

We use Fast Lyapunov indicator (FLI) as indicator of chaoticity of region.

For information about FLI, see :https://link.springer.com/chapter/10.1007/978-3-662-48410-4\_2

dx/dt = F(x)

dv/dt = \partial F / \partial x v

Use FLI we can assign potential to each point in phase space, and use Metropolis Hasting algorithm with confinement h\_{A}(x) to find most chaotic region in phase space of interest.

h\_{A}(x) = 1 if x \in A. = 0 otherwise.

2. Importance sampling :

We know one concern of comparing classical and quantum Lyapunov exponent in Arnold web is our classical calculation can be inaccurate due to small chaotic region may contribute most to results but are how to sample.

One solution is using importance sampling, which instead of sampling evenly in state space p(x) = 1 / A , we sample according to q(x) center around chaotic region we found using Metropolis Hasting algorithm.

This way, we may accurately sample classical Lyapunov exponent in phase space.

Program will have 3 part:

1 compute Fast Lyapunov exponent for point in phase space.

2 Monte Carlo Markov chain (MCMC) method for finding most chaotic region.

3 Use importance sampling to compute average Lyapunov spectrum .