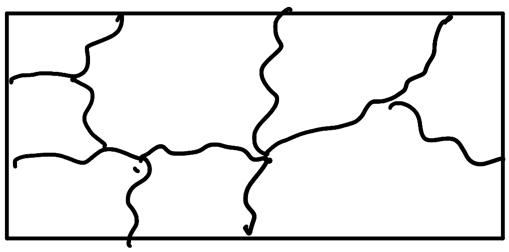
Mapping between quantum and classical dynamics

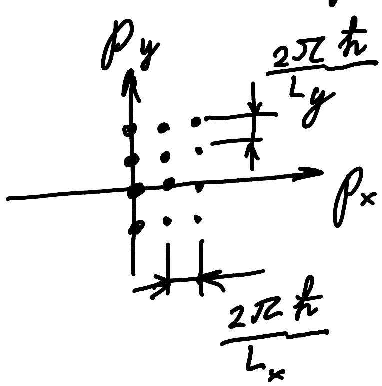
Consider an ergodic system in the quasi-classical regime = the characteristic spatial scales of change of observables are $\gg$ the wavelength



Split the system into small pieces where the system is roughly homogeneous

The size of one such piece is $d\vec{R}$
The size is still assumed to be large compared to the wavelength. Then if we insert hard walls between those pieces (the boundary conditions will not matter) it will not affect the thermodynamics in equilibrium

$\dfrac{d\vec{R}\, d\vec{p}}{(2\pi\hbar)^f}$ – the number of states in this piece with momenta in the element $d\vec{p}$



(For a 3D particle it's $\dfrac{V}{(2\pi\hbar)^3}$)

(See also Landau-Lifshitz v. 3, § 48)

In general,

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$$\boxed{N = \frac{\Gamma}{(2\pi\hbar)^f}}$$