# Statistical Mechanics

Physics 406 at **University of Michigan**

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**Lecture 1.** (Jan 05) *States, Probability and Binomial Distribution*

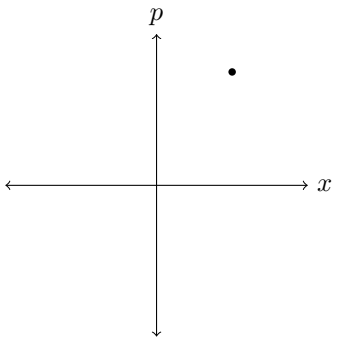


Figure 1: Phase space of 1-D particle

**Lecture 2.** (Jan 10) *Ensembles*

Lagrange multipliers

$$S = -k \sum_r p_r \ln(p_r) \tag{0.1}$$

Microcanonical ensemble: All accessible microstate are equally probable

**Lecture 3.** (Jan 12) *Finding total microstate*

$N$ particles in volume $V$ with energy between $E, E + \delta E$. Counting number of microstate by using phase space
simplifying example : a 1-D particle has only $x$ and $p$. Plot in phase space Example in harmonic oscillator with ellipse and shading in phi(E) and Omega(E) Include text in caption explaining equations below it.
Moving to 3-D talk about degrees of freedom and volume of $h_0$.
Integrating to get Phi(E) with multiintegrals and then taylor approx to get Omega
Quantum Description–¿ specify microstate with quantum numbers
example with simp harmon oscill

**Lecture 4.** (Jan 19) *More on Microcanonical Ensemble*

$\Omega(E) = \#$ of states with energy between $E + \delta E$
Describing energy levels of each particle, think N-cube
Now particle can interact!! Mechanical interactions and thermal interactions(both macro descriptions).
1 isolated system at equilibrium→ same system but with partition, now 2 systems. $A^0$ is comprised of $A, A'$.
Macro parameters of $A^0$ are for both states (N,V,E,T,...).

**Thermal Interaction** External parameters of $A, A'$ are fixed but mean energy transferred from one system to the other as a result of purely thermal interactions called heat. Probabilities of energy states can change when systems interact $P(r)$

**Mechanical Interaction** External Parameters of $A, A'$ change, one does *work* on the other! This causes the mean energies of $A, A'$ to change.

$$\overline{E} = \sum_r p_r E_r$$

Pure thermal and purely mech example in inf sqwell