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From Quantum Statistics to Dynamics with Fluctuation

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1. Introduction
2. Basic Idea
   — How to Include Quantum Fluctuation in Dynamics
   — Characteristic Features of QL Model
3. Some Applications
   — Statistics and Fragmentation at Given T
   — Time-Scale of IMF production
   — Ξ^- Absorption at Rest
4. Unsolved Problems and Challenges
   — Non-Canonical Variables
   — Strength and Matrix Form of Mobility Tensor
   — Fragment CM Motion
   — Big Bang Nucleosynthesis in the Early Universe
5. Summary

• *Quantal Langevin Eq. in Non-Caonical Variables*

⋆ Non-Antisymmetrized Molecular Dyn.

$$d\Gamma = \prod_n \frac{dr_n dp_n}{(2\pi\hbar)^3} \ , \qquad \frac{D\phi}{Dt} \equiv (\partial_t + v \cdot \nabla_r - f \cdot \nabla_p)\,\phi$$

→ Normal evolution part does not modify ϕ !

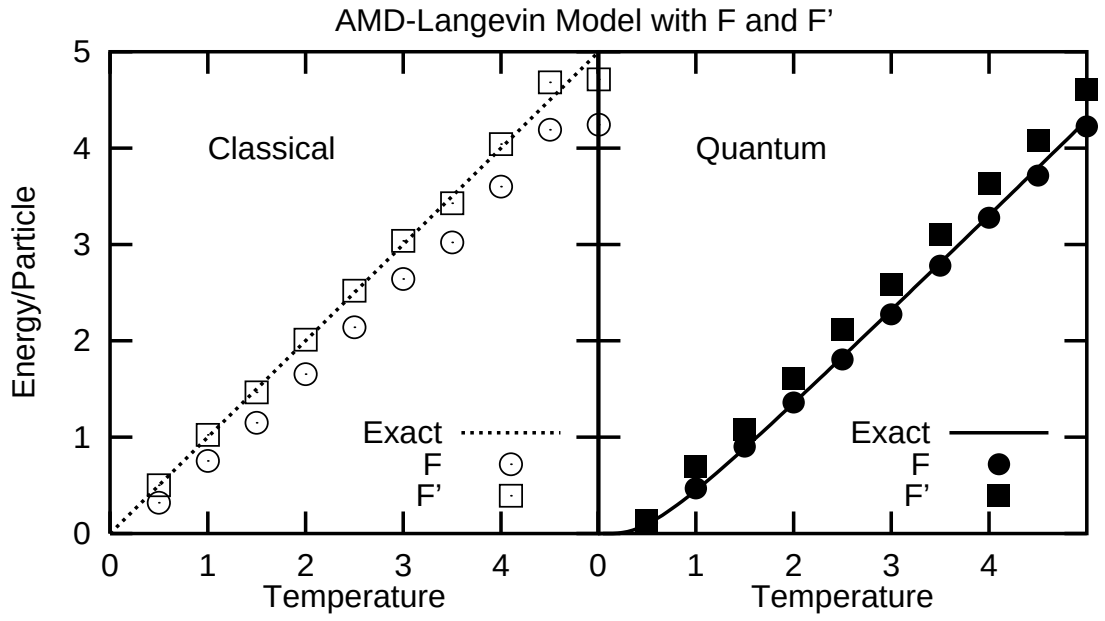
⋆ Antisymmetrized Molecular Dyn.

$$d\Gamma = \prod_n \frac{dd_n dk_n}{(2\pi\hbar)^3} \det C = \prod_n \frac{dr_n dp_n}{(2\pi\hbar)^3}$$

$$z = \sqrt{\nu} d + \frac{i}{2\hbar\sqrt{\nu}} k \ , \qquad w = \sqrt{\nu} r + \frac{i}{2\hbar\sqrt{\nu}} p$$

→ Use w, instead of z, but it becomes tedious.

→ Another way (?): $\mathcal{F} \to \mathcal{F}' = \mathcal{F} + \log\det C$



⋆ Extended S.P.W.F. (FMD, Correlated Gaussian, TDHF,...)

→ Generalized Coherent State Description ?

• *Strength and Matrix Form of Mobility Tensor*

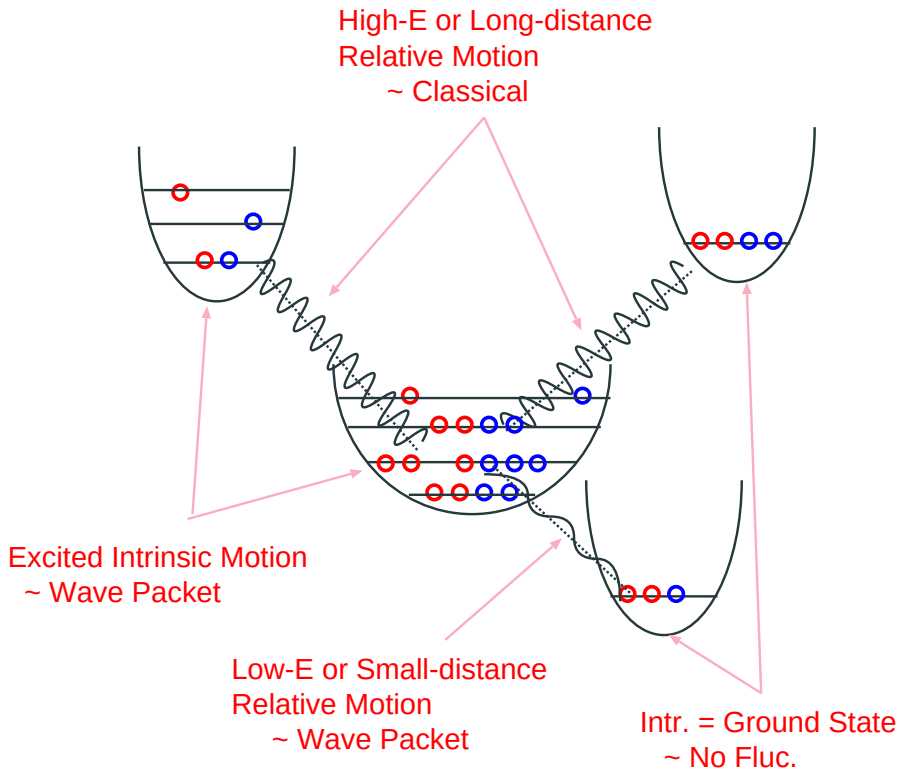
Statistical Mechanical Requirements Give ...

Neither 1. the Matrix Form of Mobitity Tensor

NOR 2. the Strength of Fluctuation.

→ To which DOF ? How Much ?

⋆ $M = g^2$ in Our Works $\cdots$ Physical Requirements



We required,...

- No Intr. Fluc. for Very Cool Fragments
- No CM Fluc. for Separated Fragments
- $M \propto \sigma(E)/\sqrt{N_F}$ of the Fragment

$$\rightarrow M \sim g\frac{\sigma_F}{\hbar\sqrt{N_F}}\,(I - \frac{1}{N_F})$$