Summary of Lecture 4

- Propagator

$$K(\vec{r},t\,|\,\vec{r}',t') \equiv \theta(t-t')\langle \vec{r}\,|\,U(t-t')\,|\,\vec{r}'\rangle$$

- Relation to Green's functions

$$\left[i\hbar\frac{\partial}{\partial t} - H\right] K(\vec{r},t\,|\,\vec{r}',t') = i\hbar\delta(t-t')\delta(\vec{r}-\vec{r}')$$

$$K(\vec{r},t\,|\,\vec{r}',t') = 0 \quad (t < t')$$

- Free particle

$$K(\vec{r},t\,|\,\vec{r}',t') \equiv \theta(t-t')\left[\frac{m}{2\pi i\hbar(t-t')}\right]^{3/2} \exp\left[-\frac{m\,|\,\vec{r}-\vec{r}'\,|^2}{2i\hbar(t-t')}\right]$$

This Lecture (5)

- The Feynman Path Integral

Summary of Lecture 5

- Propagator

$$K(\vec{r}_f, t_f | \vec{r}_i, t_i) = \int \mathscr{D}\vec{r}(t) \exp\left[\frac{\mathrm{i}}{\hbar} S[\vec{r}(t)]\right]$$

Action $$S[\vec{r}(t)] \equiv \int_{t_i}^{t_f} L(\vec{r}(t), \dot{\vec{r}}(t))\, \mathrm{d}t$$

Lagrangian $$L(\vec{r}(t), \dot{\vec{r}}(t)) \equiv \frac{m\dot{\vec{r}}^2}{2} - V(\vec{r})$$

- Propagator for the SHO

- The Semiclassical limit

Next Lecture (6)

- The JWKB method and Stationary Phase