Summary of Lecture 9

- s-wave scattering, $l = 0$, dominates at low energy

$$\sigma_{\text{tot}} \xrightarrow{k\to 0} \frac{4\pi}{k^2} \sin^2 \delta_{l=0}$$

- Scattering length $\delta_0 \to -ka \ \ (+n\pi)$ $\sigma_{\text{tot}} \to 4\pi a^2$

- Full calculation for a potential step (for $l = 0$)

[On resonance $\delta_0 \to (n + 1/2)\pi$ $\sigma_{\text{tot}} \to 4\pi/k^2$]

This Lecture (10)

- Identical Particles and Second Quantization

Summary of Lecture 10

- Creation/operators for particle in single-particle states $\{\varphi_\alpha(\mathbf{r})\}$

$$\hat{a}_\alpha^\dagger | N_0, N_1, \ldots, N_\alpha, \ldots\rangle \rightarrow \sqrt{N_\alpha + 1}\, | N_0, N_1, \ldots, N_\alpha + 1, \ldots\rangle$$

$$\hat{a}_\alpha | N_0, N_1, \ldots, N_\alpha, \ldots\rangle \rightarrow \sqrt{N_\alpha}\, | N_0, N_1, \ldots, N_\alpha - 1, \ldots\rangle$$

- Bosons/Fermions: Commutation/Anti-Commutation relations

$$[\hat{a}_\alpha, \hat{a}_\beta^\dagger]_\mp = \delta_{\alpha,\beta}$$

$$[\hat{a}_\alpha, \hat{a}_\beta]_\mp = [\hat{a}_\alpha^\dagger, \hat{a}_\beta^\dagger]_\mp = 0$$

Next Lecture (11)

- Position Basis, Operators, Correlations & Interactions