G-matrix perturbation theory

$$v \rightarrow G$$

$$G = v + v\frac{1}{e}v + v\frac{1}{e}v\frac{1}{e}v + \dots$$

$$G^{(1)} = v$$

$$G^{(2)} = v + v\frac{Q}{e}v$$

$$= v + v\frac{Q}{e}G^{(1)}$$

$$G^{(3)} = v + v\frac{Q}{e}v + v\frac{Q}{e}v\frac{Q}{e}v$$

$$= v + v\frac{Q}{e}\left(v + v\frac{Q}{e}v\right)$$

$$= v + v \frac{Q}{e} G^{(2)}$$

$$G = v + v \frac{Q}{e} G$$

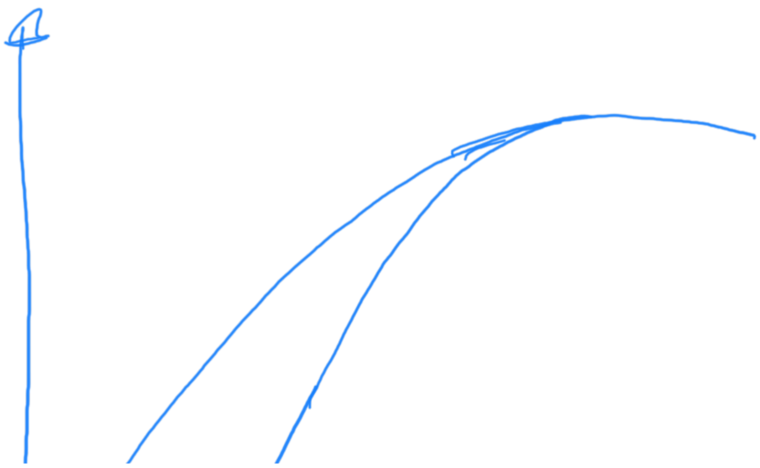
$$\langle \phi | G | \phi \rangle = \langle \phi | v + v \frac{Q}{e} G | \phi$$

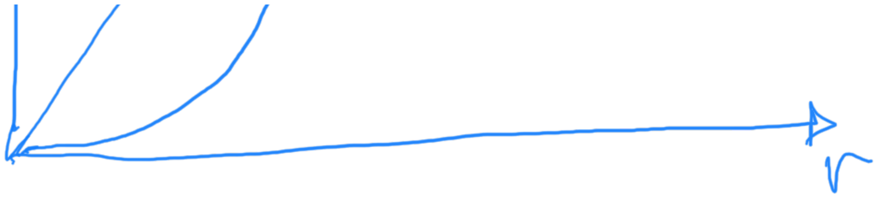
$$= \langle \phi | v \left(1 + \frac{Q}{e} G \right) | \phi \rangle$$

$$= \langle \phi | v | \psi \rangle$$

$$| \psi \rangle = | \phi \rangle + \frac{Q}{e} G | \psi \rangle$$

$$G | \phi \rangle = v | \psi \rangle$$





Perturbative expansion in G not convergent

$\Rightarrow$ hole-line expansion.

lowest order (two-hole line)

$$\sum_{\substack{k k' \\ \in \{F\}}} \left[\langle k k' | G | k k' \rangle - \langle k' k | G | k k' \rangle \right]$$

Convergence driven by density