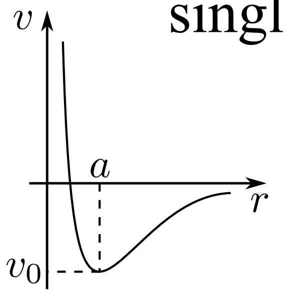
Classical localization and quantal ZPF

$$\delta x \delta k \geq 1 \qquad \varepsilon = \frac{\hbar^2 k^2}{2M} \qquad \delta k = \frac{\delta\varepsilon}{\hbar v_F} \qquad (v_{F/c} \approx 0.3)$$

$\boxed{\text{structure}}$

Independent motion of

single nucleons



$a \approx 1$ fm

$v_0 = -100$ MeV

$\delta\varepsilon = |v_0|; \delta x \approx a$

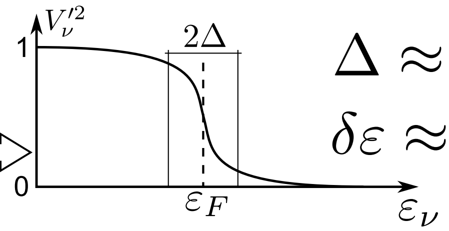
$$\delta x \delta k = \frac{a|v_0|}{\hbar v_F} \geq 1$$

quantality parameter

$$q = \frac{\hbar v_F}{a|v_0|} \approx 0.6 \lesssim 1$$

delocalization

pairs of nucleons



$\Delta \approx 1$ MeV

$\delta\varepsilon \approx 2\Delta; \delta x = \xi$

$$\delta x \delta k = \frac{\xi 2\Delta}{\hbar v_F} \geq 1$$

correlation length

$$\xi = \frac{\hbar v_F}{2\Delta} \approx 30 \text{ fm} \gg R$$

long range correlation

emergent property: generalized rigidy in

3D-space | gauge space

¿how does a short range force lead to

single-nucleon mean free paths | pairing correlations over distances

larger than nuclear dimension?

$$2R \approx 20/k_F$$

answer: quantal fluctuations

$\boxed{\text{reactions}}$

single particle transfer, e.g. *(p,d)*

$$\frac{2R}{a} \approx 15$$

absolute cross section reflects the full nucleon probability amplitude distribution, and does not depend of the specific choice of $v_{\rm np}$

Cooper pair transfer, e.g. *(p,t)*

$$\frac{\xi}{a} \approx 30$$

Successive and simultaneous transfer amplitude contributions to the absolute cross section carry equally efficiently information concerning pair correlations