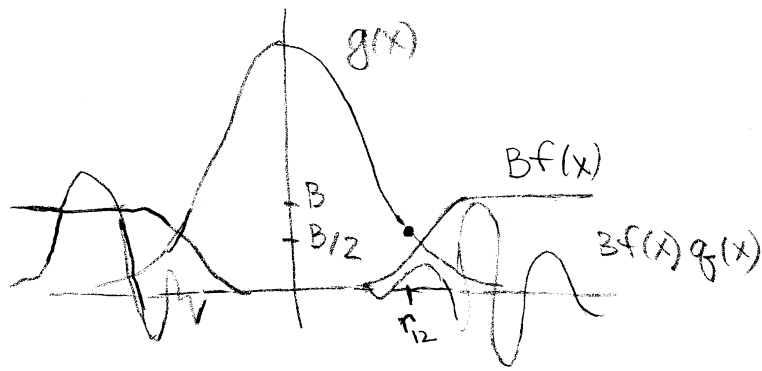# IC: superposition of collapse and random field

$$g(x) = A e^{-\left(\frac{x}{r_0}\right)^2}$$

$$f(x) = 1 - e^{-\left(\frac{x}{R_0}\right)^6}$$

$$q(x) = q_1(x) + i q_2(x)$$

random noise

$$|q(x)| \sim 1$$

$$|q_1(x)| \sim |q_2(x)| \sim \frac{\sqrt{2}}{2}$$

$$I.C. = g(x) + Bf(x)\left(q_1(x) + i q_2(x)\right)$$

Collapse parameters, A and r_0, are given

Magnitude of noise, B, is given $B \approx \langle |\psi| \rangle \approx \frac{\sqrt{N}}{L}$

Width of the hole R_0

(1) Find the location r_{12} where $g(x) = \frac{1}{2}B$:

$$A \exp\left\{-\left(\frac{r_{12}}{r_0}\right)^2\right\} = \frac{B}{2} \qquad \Longrightarrow \qquad \boxed{r_{12} = r_0 \left(\ln \frac{2A}{B}\right)^{\frac{1}{2}}}$$

(2) Consider "constant "noise function" $q = \frac{\sqrt{2}}{2} + i\frac{\sqrt{2}}{2}$

and select $f(x)$ such that

$$|g(x) + Bf(x) q| = B \qquad \text{at} \qquad x = r_{12}$$

$$\left|\frac{1}{2}B + Bf(r_{12})\left(\frac{\sqrt{2}}{2} + i\frac{\sqrt{2}}{2}\right)\right| = B$$

$$\left|1 + f(r_{12})\left(\sqrt{2} + i\sqrt{2}\right)\right| = 2$$

$$\boxed{f(r_{12}) = \frac{\sqrt{14} - \sqrt{2}}{4} \equiv f_{12}}$$

(3) Find R_0 such that $f(x)$ passes through (r_{12}, f_{12})

$$1 - \exp\left\{-(r_{12}/R_0)^6\right\} = f_{12}$$

$$\boxed{R_0 = r_{12} \left(-\ln(1 - f_{12})\right)^{-1/6}}$$