$$i\hbar\dot{\psi} = \left(\dots\dots + \frac{32}{3\sqrt{\pi}} g\sqrt{a_s^3}\left(1+\frac{3}{2}\epsilon_{dd}^2\right)|\psi|^3 \right)\psi$$

$|\psi|^3 \sim \frac{1}{\ell_{HO}^{3/2}} N^{3/2}$

$\ell_{HO} = \sqrt{\frac{\hbar}{m\omega}}$

$\int d^3x |\psi(x)|^2 = 1$

$\int d^3x N|\psi(x)|^2 = N$

$g = \frac{4\pi\hbar^2 a_s}{m}$

$$\frac{32}{3\sqrt{\pi}} \frac{4\pi\hbar a_s^{5/2}\left(1+\frac{3}{2}\epsilon_{dd}^2\right)N^{3/2}}{\hbar\omega\, \ell_{HO}^2\, \ell_{HO}^{5/2}} = \frac{32}{3\sqrt{\pi}} 4\pi \left(\frac{a_s}{\ell_{HO}}\right)^{5/2} N^{3/2}\left(1+\frac{3}{2}\epsilon_{dd}^2\right) = g_{3d}$$

- $a_s = 90\, a_0$; $a_0 = 0{,}53$ Å
- $\ell_{HO} = \sqrt{\hbar/m\omega}$; $\omega_x, \omega_y, \omega_z \equiv \omega, \lambda_y\omega, \lambda_z\omega$
- $N = 10^4$
- $\epsilon_{dd} = \frac{a_{dd}}{a_s}$
- $a_{dd} = 130\, a_0$ (^{164}Dy)

$$g \equiv 4\pi\left(\frac{a_s}{\ell_{HO}}\right)N$$

$$\frac{4\pi\hbar^2 a_{dd}}{m} = \frac{4\pi}{3}\left(\frac{a_{dd}}{\ell_{HO}a_s}\right)$$

$$i\frac{\partial}{\partial t}\psi = \left[-\frac{1}{2}\nabla^2 + \frac{1}{2}\left[x^2+\lambda_y^2 y^2+\lambda_z^2 z^2\right] + g|\psi|^2 + g\epsilon_{dd}\underbrace{\int \frac{d^3k}{(2\pi)^3} e^{i\vec{k}\vec{r}}\,\tilde{n}(\vec{k})\left[3\frac{k_z^2}{k^2}-1\right]}_{U_D(r)} + g_{3d}|\psi|^3\right]\psi$$

$\left(\frac{a_s}{\ell_{HO}}, N, \epsilon_{dd}, \lambda_y, \lambda_z\right)$

$\boxed{a_{dd} = 130\, a_0}$

$a_0 = 0{,}53\times10^{-10}$ m

Parameter: N → Anzahl von Atomen ($N \simeq 10^4$)

a_s → Streulänge ($a_s \sim 90\, a_0$) ← $\epsilon_{dd} = a_{dd}/a_s$

$\omega_x, \omega_y, \omega_z = 2\pi\,(30, 40, 160)$ → $\ell_{HO} = \sqrt{\frac{\hbar}{m\omega_x}}$

$\hbar = 10^{-34}$

$m = 164 \times 1{,}66\times10^{-27}$

$\lambda_y = \frac{\omega_y}{\omega_x}$; $\lambda_z = \frac{\omega_z}{\omega_x}$