Dipol trap

The potential of a dipole trap is

$$U_{\mathrm{dip}} = \frac{2\pi}{c}\alpha_{\mathrm{s}} I_0 = -\frac{1}{2\varepsilon_0 c}\,\mathrm{Re}(\alpha) I, \qquad \alpha = 6\pi\varepsilon_0 c^3 \frac{\Gamma/\omega_0^2}{\omega_0^2 - \omega^2 - i(\omega^3/\omega_0^2)\Gamma}, \tag{1}$$

with $\alpha_{\mathrm{s}} = 24.3 \cdot 10^{-24}\, cm^3$ static polarizability of ^{6}Li at $F = 1/2$, I_0 – intensity at the beam focusing point.

Assuming the power of the laser at the center of the ODT is 100W, the beam waist is $55\,\mu$m, and assuming the beam has to cross through a single window of the glass cell and allowing for the maximum angle between each beam and normal (11.6 deg), the potential at the trap would be 2.53 mK.

$$U(x,y,z) = \frac{2\pi}{c}\alpha_{\mathrm{s}} I(x,y,z) = U_0\left(\frac{x^2}{\rho_x^2} + \frac{y^2}{\rho_y^2} + \frac{z^2}{2}\left(\frac{1}{z_{Dx}^2} + \frac{1}{z_{Dy}^2}\right)\right) = \frac{m}{2}\omega_x^2 x^2 + \frac{m}{2}\omega_y^2 y^2 + \frac{m}{2}\omega_z^2 z^2$$

with trap frequencies

$$\omega_x = \sqrt{\frac{2U_0}{m\rho_x^2}}, \qquad \omega_y = \sqrt{\frac{2U_0}{m\omega_y^2}}, \qquad \omega_z = \sqrt{\frac{U_0}{m}\left(\frac{1}{z_{Dx}^2} + \frac{1}{z_{Dy}^2}\right)}$$

The potential depth and trap frequency are related by

$$U_0 = \frac{m(\omega_x^4 + \omega_y^4)}{4k^2\omega_z^2}.$$

$$\langle E\rangle = E_\infty + (E_0 - E_\infty)e^{-t/\tau}, \qquad \tau \propto e^{\beta\Delta E}$$