

**The explicit time-dependent Schrödinger equation for a particle in a time-dependent harmonic well**

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**Task** Solve the explicit time-dependent Schrödinger equation

$$i\hbar \frac{d}{dt} \Psi(x, t) = \hat{H} \Psi(x, t) \quad (1)$$

$$\hat{H} = -\frac{\hbar^2}{2m} \frac{d^2}{dx^2} + V(x, t) \quad (2)$$

for a time-dependent potential

$$V(x, t) = \frac{1}{2} m \omega_0^2 (|x| - |a(t)|)^2 \quad (3)$$

$$a(t) = a_0 \cos(\omega_1 \pi t) \quad (4)$$

Analyze and solve the Schrödinger equation (1) using finite difference methods. Discuss the limiting cases  $\omega_1/\omega_0 \gg 1$ ,  $\omega_1/\omega_0 \ll 1$  and  $\omega_1/\omega_0 \sim 1$ .