The Wigner-Moyal equation, which governs the time evolution of the Wigner function W(x, p, t

\frac{\partial W}{\partial t} + \frac{p}{m} \frac{\partial W}{\partial x} - \sum_{n=0}^{\inf

In this equation:
- W is the Wigner function, a quasi-probability distribution function in phase space.
- t is time.
- x and p are the position and momentum in phase space, respectively.
- m is the mass of the particle.
- \hbar is the reduced Planck's constant.
- V(x) is the potential energy as a function of position x.
- The series expansion accounts for the quantum corrections to the classical motion, with th

For the one-dimensional quantum harmonic oscillator, a particularly insightful solution to t

W(x, p) = \frac{1}{\pi \hbar} \exp \left(-\frac{2H}{\hbar \omega} \right)

where H is the Hamiltonian of the harmonic oscillator, expressed in terms of position x and

H = \frac{p^2}{2m} + \frac{1}{2}m\omega^2 x^2

Substituting the expression for H into the Wigner function, we obtain:

W(x, p) = \frac{1}{\pi \hbar} \exp \left(-\frac{p^2}{m\hbar \omega} - \frac{m\omega x^2}{\h

Yes, the Wigner function for a state centered at an arbitrary complex number in phase space

A coherent state |\alpha\rangle is often described by a complex number \alpha, where \alpha

W_{\alpha}(x, p) = \frac{1}{\pi \hbar} \exp\left(-\frac{m\omega}{\hbar}(x - x_0)^2 - \frac{1

In this expression, x_0 = \sqrt{\frac{2\hbar}{m\omega}}\Re(\alpha) and p_0 = \sqrt{2\hbar m\