18. Int. J. of Mod. Phys. B, Vol. 20, 16, (2006) Pages 2313 - 2322

Deformed Harmonic Oscillator for non - Hermitian operator and the Behavior of $PT-$ and $CPT-$ Symmetries

A. Jannussis, K. Vlachos, V. Papatheou and **A. Streklas**

Absract

In the present paper we study the deformed harmonic oscillator for the non - Hermitian operator

$$\mathcal{H} = \frac{\alpha}{2m}\left(\hat{p}_1 + \frac{\lambda}{2h}\hat{q}_2\right)^2 + \frac{\beta m\omega^2}{2}\left(\hat{q}_1 - \frac{\theta}{2\hbar}\hat{p}_2\right)^2$$

where λ, θ are real positive parameters, since the parameters α, β, m are for the general case complex.

For the case $\alpha = 1$, $\beta = 1$ and mass m real, we find the eigenfunctions and eigenvalues of energy, the coherent states, the time evolution of the operators $\hat{q}_j$, $\hat{p}_j$ in the Heisenberg picture and the uncertainty relations. In this case the operator $\mathcal{H}$ is Hermitian and $PT-$ symmetric. Also for the case m complex $\alpha = 1$, $\beta = 1$, the operator $\mathcal{H}$ is non - Hermitian and no more $PT-$ symmetric, but $CPT-$ symmetric with real discrete positive spectrum and the $CPT-$ symmetry is preserved. In the general case α, β, m complex, for the non-Hermitian operator $\mathcal{H}$, we obtain complex spectrum and for the special values of the complex parameters α, β the spectrum is real discrete and positive and the $CPT-$ symmetry is preserved. The general problem of deformed oscillator for non hermitian operators can be applied to the Solid State Physics.