SEMINARIO

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su(2) coherent states for hydrogen-like radial systems

Abstract: It is well known that the Lie algebra $su(1,1)$ generates the spectrum of the hydrogen-like radial systems. The space of states is usually decomposed into the direct sum of infinite-dimensional subspaces of definite angular momentum states, and the corresponding generalized coherent states are usually called radial coherent states [1]. In this work we show that $su(2)$ is also feasible as a dynamical algebra for these systems, a fact rarely reported in the literature on the matter. With this aim, the space of states is now decomposed into the direct sum of finite-dimensional subspaces of definite energy states. Additional finite-dimensional representations are obtained by using states such that $n+\ell=const$, with n and ℓ the principal and orbital quantum numbers respectively. Then we construct the corresponding generalized coherent states. Our approach follows the paper [2] to write the generators of the algebras in Hubbad representation [3], so no differential representations are necessary for the involved operators [4].

[1] C.C. Gerry and J. Kiefer, Radial coherent states for the Coulomb problem, Phys. Rev. A 37 (1988) 665.

[2] O. Rosas-Ortiz, S. Cruz y Cruz and M. Enríquez, $su(1,1)$ and $su(2)$ approaches to the radial oscillator: Generalized coherent states and squeezing of variances, Ann. of Phys. 373 (2016) 1780.

[3] M. Enríquez and O. Rosas-Ortiz, The Kronecker product in terms of Hubbard operators and the Clebsch-Gordan decomposition of $SU(2)\times SU(2)$, Ann. Phys. 339 (2013) 218.

[4] P. Jiménez Macías, Generalized coherent and squeezed states for hydrogen-like radial systems, M.Sc. Thesis, Cinvestav, M\'exico City (2016).

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