

# On quaternionic analysis for the Schrödinger operator and its relation with Mathieu functions.

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## Abstract

The talk is based on a joint work with María Elena Luna Elizarrarás, Ramón M. Rodríguez Dagnino and Michael Shapiro.

In this work we introduce the quaternionic analysis for the Schrödinger operator with a particular potential; the corresponding functions are called  $\mathcal{D}_k$ -hyperholomorphic. This theory is in the same relation to the Schrödinger operator as the usual holomorphic functions in one complex variable, or hyperholomorphic functions of quaternionic or Clifford analysis, is for the corresponding Laplace operator; what is more, it is similar to that of  $\alpha$ -hyperholomorphic functions for the Helmholtz operator. In the talk there will be explained all above and some basic facts of the arising quaternionic function theory, such as analogues of the basic integral formulas of the complex analysis: Borel-Pompeiu's, Cauchy's, etc. Also, we show how to directly relate the solutions of the radial and angular Mathieu equations with the  $\mathcal{D}_k$ -hyperholomorphic function theory. The angular and radial Mathieu functions were originally proposed by É. Mathieu in 1868 for finding the modes in an elliptic membrane and are solutions of the two ordinary differential equations of the second order with variable coefficients.

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