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Generalized Quantum Potentials with Hypergeometric Eigenfunctions*.

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A canonical *g(x)* transformation method to convert a general second order differential equation (DE) into a Schrödinger-like DE is presented. As a useful application of the proposal we consider explicitly the hypergeometric DE in order to find the exactly-solvable quantum potentials having hypergeometric wavefunctions. As a result, it appears that different exactly-solvable potentials can be obtained depending on the choice of the *g(x)* involved transformation. Specifically, the generalized Scarf, Posh-Teller, Eckart and Rosen-Morse trigonometric and hyperbolic potentials, are obtained by selecting *g(x)* as constant and proportional to the *P(x)* hypergeometric coefficient. Similarly, the choice $g(x) \sim P(x)/x^2$ and $g(x) \sim x^2/P(x)$ leads to the exactly-solvable generalized multiparameter exponential-type potential which contain as particular cases the Hulthén, Manning-Rosen and Woods-Saxon potentials, among others. Moreover, the proposed transformation method is general and can be straightforwardly used not only to unify the study of exactly-solvable quantum potentials with special functions solutions but also as a method to construct new potentials, provided that it can be applied to other different DE, that could be useful in quantum chemical calculations.

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