

Autores: Goos, Demian Nahuel (Departamento de Matemática e Instituto de Estudios Nucleares y Radiaciones Ionizantes, Facultad de Ciencias Exactas, Ingeniería y Agrimensura, Universidad Nacional de Rosario; demian@fceia.unr.edu.ar); Id Betan, Rodolfo (Departamento de Física e Instituto de Estudios Nucleares y Radiaciones Ionizantes, Facultad de Ciencias Exactas, Ingeniería y Agrimensura, Universidad Nacional de Rosario; idbetan@fceia.unr.edu.ar)

A linear fractional Schrödinger equation is studied, in which the differentiation operators are of fractional Caputo type:

$$i\hbar \frac{\partial^\beta \Phi}{\partial t^\beta}(x, t) = -\frac{\hbar^2}{2\mu} \frac{\partial^{2\alpha} \Phi}{\partial x^{2\alpha}}(x, t) + V(x)\Phi(x, t) \quad \forall x \in \mathbb{R}, t \in \mathbb{R}^+$$

where μ is the mass of the particle, V is the potential, $\hbar$ is Planck's reduced constant and $\alpha, \beta \in (0, \frac{1}{2}]$ are constants.

The solution to this equation within the potential well (both, the finite as well as the infinite one) is derived in order to visualize the nonlinear nature of the equation.

A numerical scheme is used in order to solve the arising nonlinear differential equation and different properties of the general model and its solutions are presented.

References

- [1] K. Diethelm, *The Analysis of Fractional Differential Equations*, Springer, Heidelberg (2004).
- [2] J. W. Hanneken, D. M. Vaught, B. N. Narahari Achar, *Enumeration of the Real Zeros of the Mittag-Leffler Function $E_\alpha(z)$* , $1 < \alpha < 2$, *Advances in Fractional Calculus*, pp 15–26, (2007).
- [3] H.J. Haubold, A.M. Mathai, R.K. Saxena, *Mittag-Leffler Functions and Their Applications*, *J. Appl. Math.*, 298–628, (2011).
- [4] E. Rebhan, *Theoretische Physik: Quantenmechanik*, Spektrum Akademischer Verlag, (2008).
- [5] V. I. Kukulin, V. M. Krasnopolsky, J. Horacek, *Theory of Resonances – Principles and Applications*, Kluwer Academic Publishers, (1988).