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Using simulated annealing techniques in solving partial differential equations governing structure and evolution of exotic atoms.

In this work, deterministic optimization techniques based on artificial neural networks are employed in order to solve partial differential equations governing the structure and evolution of exotic atomic systems. To this aim, a new method based on simulated annealing [1,2,3] with deterministic optimization is derived that optimizes appropriate parametric expressions representing the reduced radial Klein-Gordon wave functions U(r). The method is applied to concrete physical systems in order to calculate the relevant wave functions and corresponding energies of bound spinless particles orbiting around the complex nuclei of the exotic atoms. The fundamental interaction is assumed to be the Coulomb electrostatic potential. Such systems are of current experimental interest in atomic, molecular, particle and nuclear physics. The efficiency of the method is proven for also other similar systems [4].

[1] Kirkpatrick, S., Gelatt Jr, C. D., & Vecchi, M. P. Optimization by simulated annealing. Science, 1983, 220, 671-680.
[2] Kosmas, O. T., & Vlachos, D. S. Simulated annealing for optimal ship routing. Computers & Operations Research, 2012, 39, 576-581.
[3] Tsoulos, I. G., Kosmas, O. T., & Stavrou, V. N. DiracSolver: A tool for solving the Dirac equation. Computer Physics Communications, 2019, 236, 237-243.
[4] Gkrepis, A., Kosmas, O. T., Vlachos D., & Kosmas, T. Numerical solution of the Schrödinger equation using Neural Networks in Python, IC-MSQUARE 2023

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