THE ARSENAL

Augusta University's Undergraduate Research Journal

ISSN 2380-5064 | The Arsenal is published by the Augusta University Libraries | <http://guides.augusta.edu/arsenal>

Volume 4, Issue 1 (2021)
Special Edition Issue

BOUND RELATIVISTIC MOTION IN ONE DIMENSION

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Citation

Dains-McGahee, S., & Robinson, S. (2021). Bound relativistic motion in one dimension. *The Arsenal: The Undergraduate Research Journal of Augusta University*, 4(1), 9.
<http://doi.org/10.21633/issn.2380.5064/s.2020.04.01.09>

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Bound Relativistic Motion in One Dimension

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ABSTRACT

This project is a mathematical study of the relativistic dynamics of particles in one dimension moving under forces derivable from a potential. These motions and their nonrelativistic counterparts are described by Hamiltonian systems of differential equations. These Hamiltonian systems are in general nonlinear. Linear algebraic and differential equations are quite easy to solve – their solutions can be determined exactly – although the same cannot be said for nonlinear equations whose solutions can only be approximated (most of the time, with certain exceptions). We use numeric approximations to explore the relativistic and nonrelativistic simple harmonic oscillator and find that, unlike in the nonrelativistic case, the relativistic simple harmonic oscillator is not isochronous. We further study what happens to the period as the energy increases and then extend to exploring and comparing relativistic and nonrelativistic motions and periods for systems with forces given by power law potentials.

Received: 02/15/2021 Accepted: 03/30/2021

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