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PT Symmetry, Quantum Gravity, and the Metrication of the Fundamental Forces

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We discuss some recent applications of PT symmetry to fundamental physics. We show that the recognition (Bender and Mannheim) that fourth-order derivative theories are PT symmetric theories rather than Hermitian ones enables one to show that such theories are ghost free and unitary. This then permits the fourth-order derivative conformal gravity theory to be a consistent quantum theory of gravity. We show that the conformal gravity theory provides for a universal departure from Newtonian gravity on large distance scales, which enables us to universally fit (Mannheim and O'Brien) the galactic rotation curves of 141 galaxies without the need for any dark matter, and without the 282 free parameters (two per galactic halo) present in standard dark matter fits to the same set of galaxies. Finally we show that through the use of generalized geometric connections that are PT symmetric we are able to metricate the fundamental forces, to thus both complete and generalize Weyl's original attempt to provide a geometric origin to electromagnetism based on utilizing and extending to gravity the underlying conformal structure that electromagnetism possesses.

C. M. Bender and P. D. Mannheim, Physical Review Letters 100, 110402 (2008).

P. D. Mannheim and J. G. O'Brien, Physical Review Letters 106, 121101 (2011).

P. D. Mannheim, PT Symmetry, Conformal Symmetry, and the Metrication of Electromagnetism, arXiv:1407.1820 [hep-th].

Author: Prof. MANNHEIM, Philip (University of Connecticut)

Presenter: Prof. MANNHEIM, Philip (University of Connecticut)

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