
Contribution ID: **77** Type: **Talk**

# Causality constraint on bound states and scattering with zero-range force, or do perturbative pions deserve another chance?

*Monday, 29 June 2015 15:40 (15 minutes)*

The present treatment of the nucleon-nucleon and few-nucleon forces in chiral effective theory is semi-relativistic. One of the immediate difficulties of this description is that, in accordance with Wigner's causality bound, the leading-order (zero-range) interaction yields zero effective range. This leads to the necessity of "promoting"the subleading three-body force to leading order, in the pionless theory. It eventually becomes the major reason for "non-perturbative pions". I argue that these difficulties are absent in relativistically causal theory. On a simple field-theoretic example [1,2], I demostrate relativistic zero-range potential scattering surpasses Wigner's causality bound without violating causality [3]. The relativistic theory exhibits a K-matrix pole necessarily accompanying the bound-state solution. Possible implications of these results for the effective-field theory of nuclear forces will be discussed, time permitting.

References

1. V. Pascalutsa and M. Vanderhaeghen, "Sum rules for light-by-light scattering", Phys. Rev. Lett. 105 (2010) 201603 [arXiv:1008.1088 [hep-ph]].
2. V. Pauk, V. Pascalutsa and M. Vanderhaeghen, "Analytic structure of φ4 theory using light-by-light sum rules,"Phys. Lett. B 725 (2013) 504.
3. V. Pascalutsa, "Surpassing Wigner's causality bound in relativistic scattering with zero-range interaction," arXiv:1402.4973 [nucl-th].

**Primary author:** PASCALUTSA, Vladimir (Johannes Gutenberg University, Mainz)

**Presenter:** PASCALUTSA, Vladimir (Johannes Gutenberg University, Mainz)

**Session Classification:** Parallel Session 1 - Few-Body Physics WG

**Track Classification:** Few-Body Physics Working Group