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Simple trigonometric proof for the new parameters of the σ meson

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Collaboration

Abstract content

The recent precise determination of the σ meson parameters ($f_0(500)$ meson) was done in analysis of new dispersion relations with imposed crossing symmetry condition [1,2]. Although results of this analysis are widely accepted, one can still find studies which use previous, significantly different values of the mass and the width of that resonance. Although results of that dispersive analysis have already changed significantly parameters of the σ meson in the Particle Data Tables [3], it is still necessary to present a simpler and more intuitive proof of correctness of these results. Here, the simple proof based on a purely mathematical relations and properties of analytic functions is presented. It is shown that the mere analysis of amplitudes presented as trigonometric functions and derivatives of these functions clearly define the area in which σ mass and the width must be. Achieving these results requires also a simple analysis of the signs of integral over the physical region. One can expect that this simple proof will be sufficiently convincing and will eliminate still existing doubts about the parameters of σ meson.
[1] R. Garcia-Martin et al., Phys. Rev. D83, 074004 (2011) [2] R. Garcia-Martin et al. Phys. Rev. Lett. 107 (2011) 072001 [3] "2013 Review of Particle Physics", J. Beringer et al. (Particle Data Group), Phys. Rev. D86, 010001 (2012)

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