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Removing the Wigner bound in non-perturbative EFT

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The Wigner bound is examined at different non-perturbative pionless effective field theory (*slash* π EFT) orders. Using cutoff regulator we show that the Wigner bound loosens when going from the next-to-leading-order (NLO) to the next-to-next-to-leading-order (N²LO), and up to N⁶LO. We conjecture an analytic formula for the general dependence of the Wigner bound on the theory's order. It follows that the bound vanishes in limit of infinite order. Surprisingly, we find that the functional behaviour of the Wigner bound is regulator dependent. We demonstrate that the above surmise still holds after renormalization at finite cutoff. Furthermore, for the non-perturbative approach, we find that there exist multiple renormalization choices, only one of which is physical. A method to pick the physical solution is suggested.

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