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Singular values as neutrino mixing quantifiers

The neutrino mixing matrix is characterized by singular values and
contractions. The method of unitary dilation is introduced to extend
3-dimensional mixing matrices to a full unitary matrix. The minimal
dimension of such an extension is not arbitrary but depends on
singular values. It means that singular values encode information
about the number of additional neutrinos. Taking this into account,
scenarios with a different number of additional, non-standard
neutrinos are investigated. For the 3+1 scenario (one additional
neutrino) analytical formula for the light-heavy mixing between
SM-active and a right-handed neutrino as a function of singular values
is derived. New stringent bounds on light-heavy mixings are established.
In particular, in a seesaw mass scheme with one heavy sterile neutrino,
the upper bounds on active-sterile neutrino mixings are even two times
stringent than so far.

Mini-abstract

Bounds for the active-sterile neutrino mixing are derived based on advanced matrix theory methods.

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