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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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