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Parallelizing the computation of neutrino oscillation parameters in a general background medium, by using the Jacobi Method

This work describes an alternative tool for the study of matter effects over neutrino propagation, by numerically describing the mixing amplitudes and mass splittings as a function of a single parameter. It allows the description of these observables in the same manner as it is commonly seen in 2-neutrino phenomenology, identifying resonant mixing and level crossing, except in a N-neutrino scenario. This is accomplished by sequentially applying the Jacobi diagonalization method over a defined and smooth path, in infinitesimal steps, transporting the information about the neutrino mixing and parametrization from one background to another. This transport occurs in the parameter space, thus being reliable even over spatial background discontinuities. Due to the nature of the neutrino mass-flavor mixing, it is possible to describe any background effects, in a model-independent way, by making use of the vacuum mixing only. This is computationally interesting since the workload can be split in two stages, separating the diagonalization from the physical interpretation and fitting of any model in question. The procedure is detailed and benchmarked against known analytical solutions, together with a complexity and computational-time analysis.

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