Neutrino oscillation experiments have provided us with our only direct proof of physics beyond the standard model (BSM) in the form of lepton flavour violation in neutrino propagation due to neutrino masses and flavour mixing in the leptonic sector. In this talk I will discuss other new physics effects that can also appear neutrino oscillations on which I have been working lately. I will mainly focus on non standard neutrino interactions (NSI) which can affect neutrino propagation in matter. I will review how they introduce an intrinsic degeneracy in the relevant oscillation probabilities, which was first revealed as the existence of the LMA-D solution in solar neutrinos. In the context of 3$\nu$ mixing, the LMA-D degeneracy makes it impossible to determine the neutrino mass ordering by oscillation experiments and can confuse the determination of the source of CP violation, and therefore jeopardizes one of the main goals of the upcoming neutrino oscillation program. I will discuss the status of these effects and the corresponding constraints from the present oscillation analysis. Non-oscillation data such as that from neutrino scattering experiments is needed to break this degeneracy. I will present recent results on the analysis of coherent elastic neutrino--nucleus scattering (CEnuNS), recently observed for the first time at COHERENT, to constraint NSI and on the potential of a new generation of CEnuNS experiments proposed at the European Spallation Source to further test BSM neutrino scenarios. I will also comment on attempts to find suitable Z' models to generate large enough NSI.