Model dependences, uncertainties, and combined analysis

Intro

- Cosmological neutrino mass limits are robust for a given, well-defined model, e.g., LCDM +mnu.

- Cosmological neutrino mass limits and also 0nbb arise from an inference process, not from a direct observable (no info on, e.g., quantum numbers).

- Direct measurements at lab have the final say on m_nu.

Model dependences & methods

- Distinguish between real, observational systematics and uncertainties in the cosmological model.
- In the foreseeable future, no need to distinguish between sensitivity and detection threshold for forecasts, but may be required further down the road (also dependence on the choice of the fiducial model for forecasts)
- We don't believe priors are an issue in MCMC.
- Nu mass limits are robust within reasonable extensions of LCDM.
- Inconsistency between KATRIN and cosmology may provide new insights into cosmological models.

0nbb

- No improvement in matrix elements expected in the next five years.

- Probe of lepton number violation. The inferred neutrino mass is model-dependent and very uncertain.

- Inconsistency between KATRIN and 0nbb is not necessarily an indication of new physics.

- Has the potential to exclude the inverted hierarchy.

Work to be done (theory)

- Nonlinear power spectrum beyond standard LCDM. (*)

- Reconciling the massive and the massless neutrino modules in CMB Boltzmann codes in the m_nu -> 0 limit. (*)

- Baryon physics/hydro simulations for cosmic shear.

Work to be done (with data)

- "Internal" cross checks between different methods and between probes of the same observable.

- Sum of masses vs individual masses consistent with oscillation experiments (or the alpha parameter a la de Bernardis/Slosar).

Combined analysis

- If KATRIN finds something:
  - * Combined analysis can serve as a consistency test and may allow for extraction of Majorana phases.
  - When combined with cosmology, neutrino masses can be measured with significantly better precision.
- If KATRIN doesn't find anything:
  - If cosmology sees something, goto *
  - If nobody sees anything, combined analysis remains the only way forward.