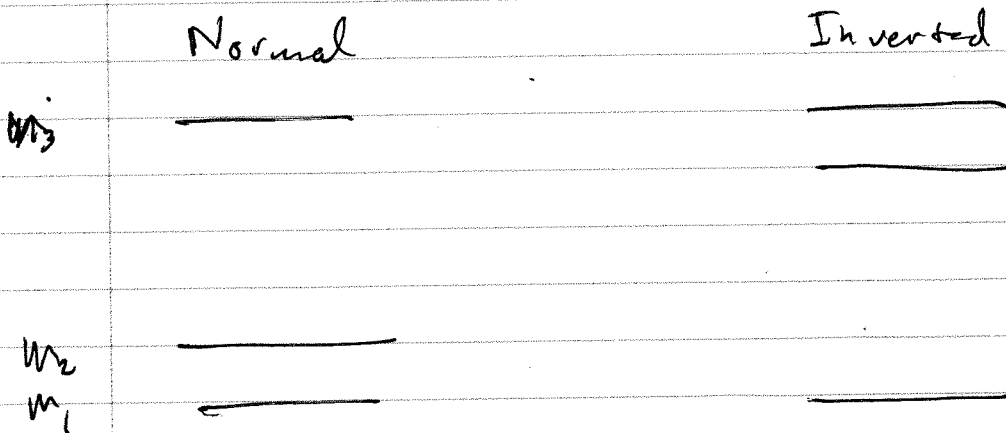


# Neutrino hierarchy



$$\Delta m_{\text{atm}}^2 > \Delta m_{\text{solar}}^2$$

atmospheric oscillation require larger splitting than solar

Lowest mass  $m_1$  could be zero; but doesn't have to be

Minimum mass:  $\sum m_\nu \geq 0.06 \text{ eV}$

for normal hierarchy with  $m_1 = 0$

Inverted hierarchy requires at least  $\sum m_\nu = 0.12 \text{ eV}$

Structure formation constraints from Planck

want  $\sum m_\nu \leq 0.12 \text{ eV}$