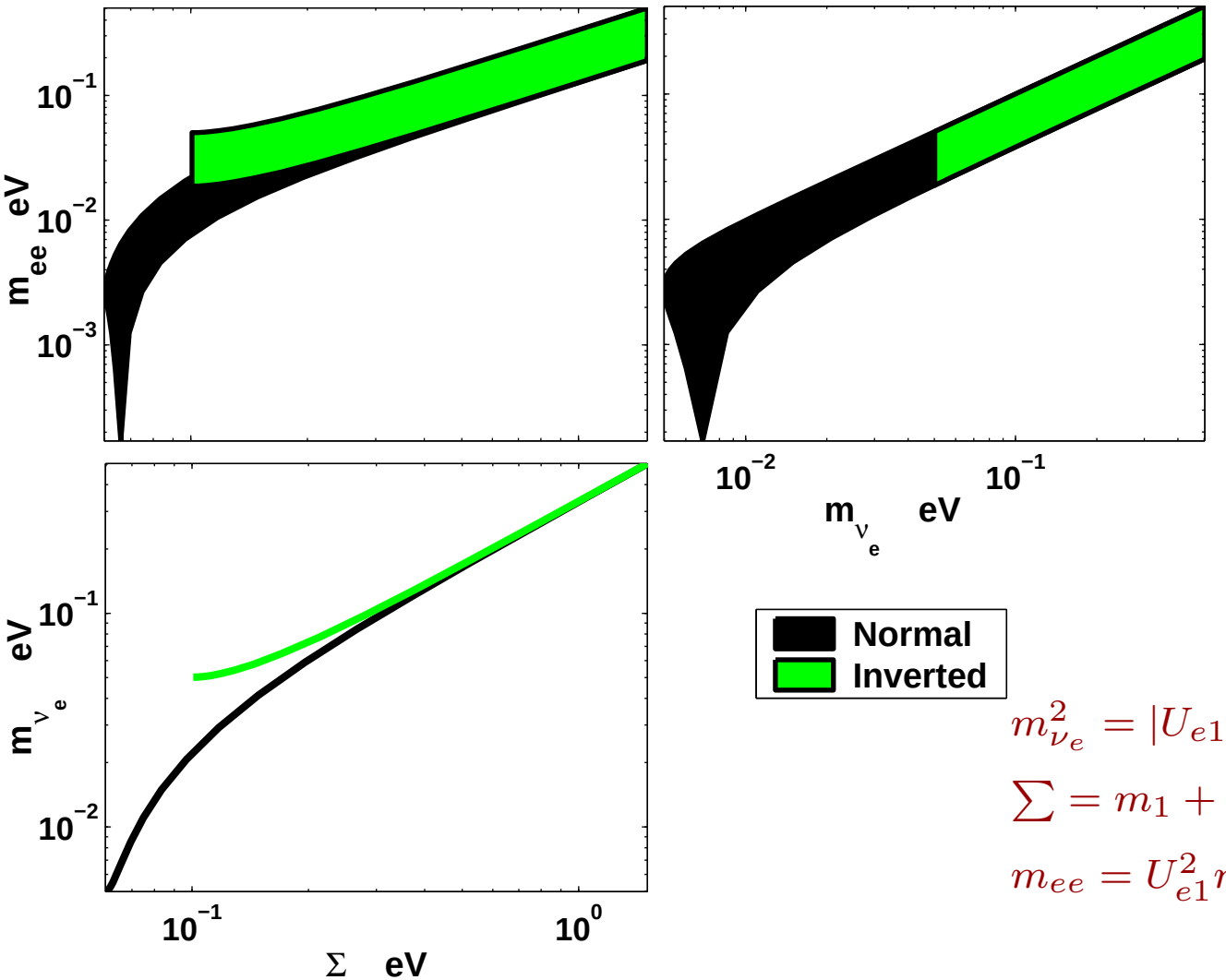
A Few Comments and Questions

- Cosmological observables offer a unique opportunity to learn about neutrino properties. Reach superior to that of lab experiments – but think complementarity!
- Main issue: how do we know we are learning about neutrinos?
  - What if there is something out there mimicking neutrinos?
  - Systematics: results seem to fluctuate depending on which observables are being used, which assumptions are being made.
  - "Robustness" of result. Can we trust a positive result?
- Will we learned about neutrinos from cosmology, or about cosmology from neutrinos?

Combining the Different Neutrino Mass Observables – Fundamental



$$m^2_{\nu_e} = |U_{e1}|^2 m_1^2 + |U_{e2}|^2 m_2^2 + |U_{e3}|^2 m_3^2$$

$$\sum = m_1 + m_2 + m_3$$

$$m_{ee} = U_{e1}^2 m_1 + U_{e2}^2 m_2 + U_{e3}^2 m_3$$

[Illustrative only, for $U_{e3} = 0$, $\Delta m^{2+}_{13} = +2.50 \times 10^{-3}$ eV^2, $\Delta m^{2-}_{13} = -2.44 \times 10^{-3}$ eV^2]