Many (all) the questions have been answered during the Q&A period. Nevertheless, we ask that you provide written answers below so students can come back to read them again. Thanks!

1. Fermi said to Dyson with 3 free parameters we can fit an elephant, 19 free parameters are we serious? aren't we stretching a funnel to a torus?

KS answer: the structure of the SM is such that there is not complete freedom in fitting the parameters– it's not like a 19 parameter polynomial! In practice, you can't fit an elephant while keeping all the parameters consistent with the data.

2. We "complain" that Standard Model does not explain neutrino mass. Why do we focus on this when SM also does not explain quark mass?

KS answer: it depends a bit on what you mean by "explain". The quark and neutrino situations are qualitatively different in the SM. Non-zero quark masses are accommodated within the structure of the SM, even though the SM does not tell you what the values of the masses are– the quark masses are parameters that must be experimentally measured. In contrast, the SM as an SU(3)xSU(2)xU(1) gauge field theory with the given particle content does not accommodate non-zero neutrino masses at all. Something has to change in the structure of the theory in order to accommodate non-zero neutrino mass. (The SM *also* doesn't explain the values of the neutrino masses, which is a kind of separate problem to solve).

3. Do you consider Koide mass formula (see for example https://en.wikipedia.org/wiki/Koide_formula) for leptons as something standard model cannot explain or is it just a numerical coincidence

KS answer: I don't think anyone knows the answer to that. That such an empirical formula works reasonably well might be just a coincidence, or it might possibly stem from a deeper theory that nobody has thought of yet.

4. DUNE has 4x10 K ton while Hyper-K has ~250K Ton. Is DUNE competitive?

The two different experiments have very different pros and cons. DUNE is capable of much high-resolution final state reconstruction (no loss of heavy particles due to Cherenkov threshold), so in principle has higher efficiency and sensitivity for a given detector mass. DUNE has a longer baseline, which gives much better sensitivity to the mass ordering, since the neutrinos pass through more matter, which enhances the mass ordering effect. DUNE's beam is also broader in energy, which gives more information about the oscillation for a broader range of parameters– HK's beam is more tuned to give the best sensitivity at specific parameters. The relative sensitivity of the two experiments in general depends on what the actual values of the oscillation parameters are.

I can add that for astrophysics, the two experiments are highly complementary– for example, DUNE is mostly sensitive to nue and HK to nuebar for a core-collapse supernova burst, so that both experiments are needed for the best information from an observation.