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. Is there any reason to believe that the weak interactions had to be chiral & not vector-like as is QED or QCD?
   Weak interactions were thought to be vector-like, just as QED and QCD for a long time. Fermi's theory of beta decay assumed, for example, that the interaction is vector-like. Experiments done by C.S. Wu and others showed that purely vector-like weak interactions are not consistent with observations in nuclear beta decay, muon decay, etc. Such vector-like interactions would require right-handed neutrinos behaving exactly like left-handed neutrinos. Nature does not follow this rule – right-handed neutrinos are not seen at all in Nature.

2. (Page 2) What do you mean by when you said that V - A structure violates parity maximally?
   A general interaction of vector-boson is a sum of (V-A) current and (V+A) current. When the strengths of these two currents are equal, Parity is conserved. The maximal Parity asymmetry one could have is when either (V-A) current exists without any (V+A) current, or vice versa. It is in this sense that (V-A) structure of weak interactions violates Parity maximally.

3. You said W_R & Z_R are heavy versions of the SM gauge bosons. Do they just couple like the SM but with L->R & how heavy are they?
   The couplings of W_R is exactly like the couplings of the standard model W_L, except that the handedness of the fermions are flipped from left to right. Z_R couplings is similar to Z_L couplings, again with handedness flipped from left to right, but this is not quite exact, as the U(1) factor in the gauge symmetry modifies this somewhat. When postulated, these W_R and Z_R were thought to be somewhat heavier than W and Z, with masses of order few hundred GeV. However, subsequent calculations showed that W_R mass should be > 2.5 TeV (from K_L-K_S mass difference).

4. If parity violation is assumed to be a broken symmetry, does CP violation become a broken symmetry too, or are there other explanations for CPV?

Parity violation can be spontaneous, but CP can still be explicitly broken. This is what happens in the minimal left-right symmetric models. However, it is also possible that both Parity and CP are spontaneously broken in this setup. If so, one would realize the pseudo-manisfest left-right symmetry where the CKM matrices of W_L and W_R are complex conjugates of each other. In this case CP violation in Kaon system can be explained even with only two generations, through the phases of the right-handed CKM matrix.

5. (Page 9) The second bullet says "Parity may be an unbroken symmetry. A mirror sector exists, which facilitates Left ↔ Right symmetry." How do we accommodate the observations?
   The observations are consistent with the existence of a mirror sector. The particles in the mirror sector only interact with mirror W, mirror Z and mirror photon. Thus, these particles behave as dark matter for our universe. If there is a symmetry that exchanges electron with mirror electron, for example, it would not modify the properties of the electron at all. Mirror proton and mirror Hydrogen are candidates for dark matter for our universe (and proton and Hydrogen would behave as dark matter for the mirror universe).

6. How can neutrino be a Dirac particle and still have Majorana mass?
   If neutrino has a Majorana mass, it is a Majorana particle. In some situations lepton number is not broken, in which case any neutrino mass would be of the Dirac type. There are also scenarios where the neutrino behaves like a Dirac fermion, although it has a Majorana mass. This happens when the Majorana masses are much smaller than the Dirac masses. This situation gives rise to what are called pseudo-Dirac neutrinos. That is, experiments would indicate Dirac nature (e.g. no signal of neutrinoless double beta decay), but fundamentally the particle is a Majorana fermion.

7. How can neutrinos be massless, but acquire mass with radiative corrections?
   This could happen if lepton number is broken in the Lagrangian, but only in the charged sector. This breaking of lepton number would be transmitted to the neutrino sector via quantum loops. Zee model of neutrino mass is a nice example. Right-handed neutrinos are absent in this setup, which may not go well with Parity symmetric theories. I also showed an example within Parity symmetric theories how a Dirac neutrino mass term may be induced via two-loop quantum corrections involving W_L and W_R gauge bosons.

8. What are masses for mirror partners? If mirror partners have the same masses like SM particles, the reason behind not observing them may be that those are neutral under SM gauge group. But is there any motivation behind taking a mirror universe like this? Is there any mirror gauge group also ?
Yes, the mirror universe is motivated by the desire to have exact Parity symmetry. The mirror particle masses are the same as the normal particle masses. The mirror particles are neutral under the Standard Model gauge symmetries, and to us would appear to be dark. The mirror sector has its own gauge group, which is a replica of the Standard Model gauge group. The motivations for mirror world are (i) realizing exact Parity symmetry, (ii) identifying mirror proton or mirror Hydrogen as dark matter to our universe, and possibly (iii) realizing Dirac neutrinos with small masses.