

Questions and answers - Tim Tait Lecture 2

The following questions were submitted through Zoom Q&A. Some / all may have been answered in the Q&A session already. Nevertheless, we request our lecturers to provide written answers here for the benefit of those who could not attend that session. Thank you!

(1) Why papers related to Extra dimensions are decreasing, is it already ruled out?

Extra dimensions are not ruled out, and there is still a lot of activity particularly for warped / Randall-Sundrum extra dimensions, in part because of their connection to strongly coupled theories by the AdS/CFT correspondence.

(2) R is defined using B, L and S. Can we simply define particles and superpartners to have ± 1 without a formula relating it to other quantum numbers. Or does the formula have other implications?

You could define it just that way, and this would be a natural thing to do if you started from the Lagrangian for the softly broken MSSM. If you wanted to make sure that the symmetry is consistent with supersymmetry, it is easier if you use the form in terms of B, L, and S. But either way works!

(3) Is the assumption of an additional symmetry that makes this possible based on anything that we know or is it just required by the math?

It's not required, it just helps deal with potential problems from proton decay, and of course allows for a stable dark matter particle.

(4) What is behind the vertical bands in the plot on slide #47?

The searches for mediators using their direct production and decay to SM particles doesn't depend strongly on the dark matter mass, and thus the bounds vary more with the mediator mass. Note that within each band, the bound is different above the limit where the mediator can decay into two DM particles, or below it, where it cannot.

(5) What is your opinion on the Two Higgs Doublet Model as a UV complete non supersymmetric DM candidate? What are its limitations with respect to models with SUSY?

It's an interesting simplified model. It's usually called the 'inert Higgs doublet model'.

