

'Crucial steps towards comprehensive theory on the forces of nature'

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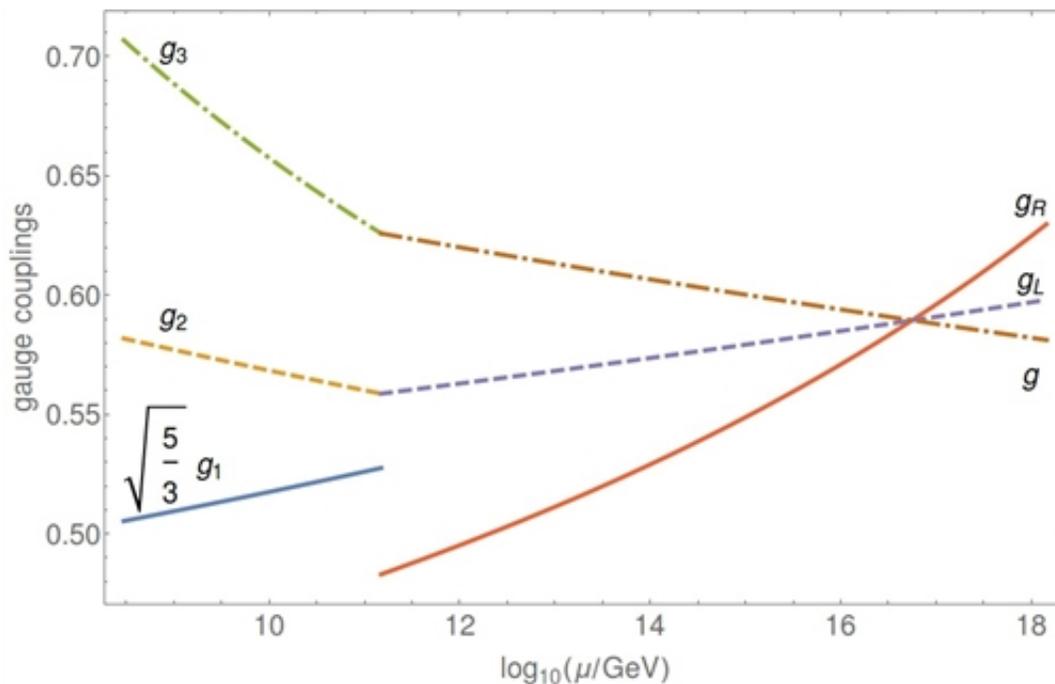


Figure 1. This figure shows the unification of the electromagnetic force and the weak and strong nuclear force.

The merging of the electromagnetic and the weak and strong nuclear force into one single force has been a holy grail for physicists for a long time. Mathematical physicist Walter van Suijlekom now shows this so-called 'grand unification' for the first time in a model, previously developed with colleagues from France and Lebanon. *The Journal of High Energy Physics* publishes the results on November 9, 2015.

In his Theory of relativity, Einstein describes gravity but omits the [electromagnetic force](#) and the weak and strong nuclear [force](#). With non-commutative geometry, mathematical physicists try to unify these forces into one single force. The grand unification of these forces has previously been mentioned as an argument for supersymmetry and for string theory.

Particles beyond the Standard Model

"This publication is a crucial step towards a comprehensive theory on the forces of nature", Van Suijlekom explains. "Our new model was derived in the framework of non-commutative geometry and has a direct coupling with the Standard Model. Therefore, the current publication confirms our approach in non-commutative geometry and it gives us direction where to search for particles beyond the Standard Model."

So what do these fundamental, mathematical results bring us? "Our model can now be confirmed at low energies in CERN", Van Suijlekom explains. "And it offers possibilities to do more accurate predictions on for instance the mass of particles, because these predictions are now based on solid mathematics."

The article by Van Suijlekom and colleagues has only recently been published, but phenomenological physicists have already used it in new research. They re-calculated the results, confirmed the described results and immediately checked a few extra cases.

More information: Ali H. Chamseddine et al. Grand unification in the spectral Pati-Salam model, *Journal of High Energy Physics* (2015). [DOI: 10.1007/JHEP11\(2015\)011](https://doi.org/10.1007/JHEP11(2015)011)

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