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Magical eraser in supersymmetry

The standard model is known as the most fundamental law of physics. It successfully describes a wide range of physical phenomenon along with the behavior of elementary particles including quarks and leptons. However, its structure casts deep theoretical mysteries, and a handful of phenomena remain to be explained, such as the existence of dark matter. Thus, it has been widely believed for decades that there is a more fundamental principle beyond the standard model.

“Supersymmetry is a leading candidate for such new physics.” says Ken-Ichi Okumura, a specially appointed assistant professor of the Research Center for Advanced Particle Physics at Kyushu University. “Supersymmetry introduces partners for every standard model particle having opposite statics, and their masses are predicted by the mechanism of ‘supersymmetry breaking.’”

In a new study published in *Physical Review Letters*, Okumura studied a supersymmetry breaking mechanism inspired by the superstring theory called modulus mediation. He found that quantum corrections to supersymmetric particle masses coming from heavy particles magically disappear if they are heavy due to “nonperturbative” dynamics under some plausible conditions, which is often the case in superstring theory.

This new effect, for example, suppresses processes like muon-electron conversion, which were previously predicted to occur too often in some supersymmetric grand unified theories.

“Now such models could be revived again and become targets of next generation experiments,” comments Okumura.

The effect also has potentially far reaching implications for a variety of predictions in supersymmetry models, which are now under investigation.

For more information about this research, see “Hide and seek with massive fields in modulus mediation,” Ken-ichi Okumura, *Physical Review Letters* (2019), https://doi.org/10.1103/PhysRevLett.123.151801

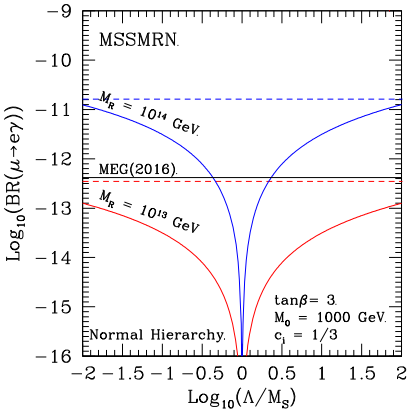

Fig. 1. The rate of muon-electron conversion.
The horizontal axis indicates the parameter of nonperturbative mass.

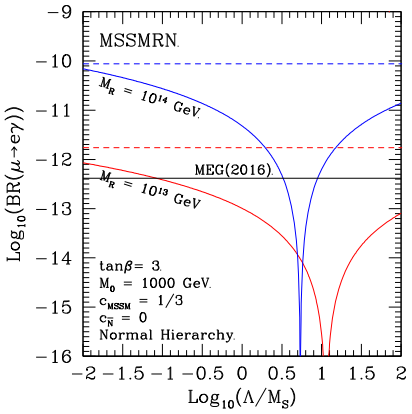

Fig. 2. The rate of muon-electron conversion.
The required conditions are violated, but the effect of nonperturbatve mass still remains.

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