

Supersymmetry Theory Review

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Philosophy of the Supersymmetry Theory Review

- Provides motivation for supersymmetry (SUSY) searches
 - Theoretical arguments for TeV-scale supersymmetry
 - Supersymmetry as a model for the phenomenology of new physics beyond the Standard Model
- Establishing the framework for SUSY searches
 - The 124 dimensional parameter space of the minimal supersymmetric model (MSSM)
 - Models of SUSY-breaking to reduce the MSSM parameter space
- Providing the context for experimental SUSY searches
 - relevant for the SUSY experimental review
 - relevant for the SUSY search listings of the PDG
- Provides a review (and references) for graduate students and (experimental) researchers

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Key ingredients of the Supersymmetry Theory Review

- Defining and identifying the SUSY parameters and particles of the MSSM
 - Superpartners: the targets of the SUSY searches
 - SUSY parameters: they control the basic properties of the SUSY particles and interactions
 - The (N)LSP and the relevance of missing energy
- Framework for the SUSY interpretation
 - R-parity conservation vs. R-parity violation
 - Reducing the parameter freedom of the SUSY model
 - different frameworks for the (unknown) SUSY-breaking mechanism
 - beyond the minimal structures and assumptions
- Connections to the Higgs sector and dark matter
- Naturalness and the energy scale of SUSY parameters

What is omitted from the Supersymmetry Theory Review

- Comprehensive treatment of SUSY phenomenology and search techniques
- More complete treatments of the MSSM Higgs sector and SUSY dark matter
 - Higgs review and dark matter reviews provide places for these treatments

Should the SUSY Theory and Experimental reviews be combined into one review?

- This possibility had been considered in the past.
- One reason for rejecting this approach is that the time required to produce a unified review is almost certainly larger than the total time to produce two separate reviews.
- Separated reviews produce cleaner results. Each review has its own constituency. (The Higgs review would benefit from such a separation.)

Major issues for the upcoming Supersymmetry Theory Review

- Implications of the negative results of SUSY searches
 - Why SUSY is not dead
 - Tensions with naturalness
 - Implications of the (Standard Model–like) Higgs boson discovery
 - Theoretical approaches to addressing the little hierarchy problem
 - Possible holes in the standard SUSY searches
 - Relaxing naturalness constraints (mini-split, etc.)
- Does the SUSY Experimental review require more discussion of the topics now treated or the inclusion of additional topics in the Theory review?
- Do the SUSY Search Listings involve searches that require further introductory material in the Supersymmetry Theory review?
- Is there too much information in the Supersymmetry Theory review?
 - Can the Supersymmetry Theory review be (significantly) shortened?