

Simplicity and Effectiveness in Physics of the Unknown

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If physics is a science that unveils the fundamental laws of nature, then the appearance of mathematical concepts in its language can be surprising or even mysterious. This was Eugene Wigner's argument in 1960. The debate on naturalness brings forth a tension between the values of effectiveness and simplicity of the mathematical formalism. On the examples of the S-matrix approach in quantum field theory and effective field theories, I show how one builds a theory from fundamental principles, employing them as constraints within a general mathematical framework. The rise of such theories of the unknown ("blackbox" or "device-independent" models) drives home the unsurprising effectiveness of mathematics.

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