

Naturalness, Finetuning, Fixed Points, and the Likelihood of a Theory

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A key role that naturalness plays in particle physics is the narrowing of focus and the status elevation of speculative theories. There are several ways a speculative theory's status can be elevated, including the assessment that it is more likely than other speculative theories. It is argued that naturalness claims on speculative theories are just those – claims that natural theories are more likely than unnatural theories. Yet, putting such claims on firm statistical foundation requires knowledge of an a priori statistical distribution of theory parameters, which constitutes disquieting additional speculative input beyond normal theory construction. The role of fixed points is also considered, which may provide answers relatively independent of parameter distributions. It is also discussed how useful finetuning is as a numerical functional for naturalness assessments. Finally, it is argued that a central implication of naturalness skepticism is that the likelihood status of any speculative theory should not be diminished when there is at least one concordant theory point in parameter space remaining.

Author: WELLS, James Daniel (University of Michigan (US))

Presenter: WELLS, James Daniel (University of Michigan (US))

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