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MÜNCHEN

ARNOLD SOMMERFELD
CENTER FOR THEORETICAL PHYSICS



Arnold Sommerfeld Lecture Series

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Sommerfeld Theory Colloquium:

Sloppy Models and How Science Works

“With four parameters I can fit an elephant; with five I can make it wag its tail.” Systems biology models of the cell have an enormous number of reactions between proteins, RNA, and DNA whose rates (parameters) are hard to measure. Models of climate change, ecosystems, and macroeconomics also have parameters that are hard or impossible to measure directly. If we fit these unknown parameters, fiddling with them until they agree with past experiments, how much can we trust their predictions?

Multiparameter fits are *sloppy*; the parameters can vary over enormous ranges and still agree with past experiments. Nonetheless, they can often make useful predictions about future experiments, even allowing for these huge parameter uncertainties: a few *stiff* combinations of parameters govern the behavior. Third, these sloppy models all appear strikingly similar to one another – for example, the stiffnesses in every case we’ve studied are spread roughly uniformly over a range of over a million. We will use ideas and methods from differential geometry to explain what sloppiness is and why it happens so often. Finally, we shall show that models in physics are also sloppy – that sloppiness makes science possible.

Thursday, January 16, 2014, 12:15 h, Room A348/349, Theresienstr. 37/III, LMU