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Inferring Details of a Genetic Toggle Switch Network Using Maximum Caliber[1] STEPHEN WEDEKIND, TAYLOR FIRMAN, KINGSHUK GHOSH, University of Denver — Genetic networks are difficult to characterize, since typical experiments monitor only a few proteins, much less than the actual number of actors involved in the process of gene expression. We aim to learn about the details of the underlying network and the intermediate/hidden species by utilizing crucial information encoded in the stochastic protein expression trajectories recorded over long time. We will exploit this idea using the detailed noise statistics in both protein species of a genetic toggle switch network to successfully infer relevant details of the underlying network – even when unaware of mRNA levels – using the principle of Maximum Caliber (the equivalent of Maximum Entropy for dynamics). Using only the simple constraints of protein production, degradation, and mutual repression, the minimal model can reproduce the qualitative features of a switch, as well as quantitative estimates such as protein number and dwell time distributions and reaction rate parameters.

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