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Special NETADIS Session on Statistical Mechanics of Inference

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Tue. June 16, 14:00-16:00:

SPEAKER: Barbara BRAVI (King's College London, UK)

TITLE: "Extended Plefka Expansion for Stochastic Dynamics "

ABSTRACT:

We propose an extension of the Plefka expansion, which is well known for the dynamics of discrete spins, to stochastic differential equations with continuous degrees of freedom and exhibiting generic nonlinearities. The scenario is sufficiently general to allow application to e.g. biochemical networks involved in metabolism and regulation. The main feature of our approach is to constrain in the Plefka expansion not just first moments akin to magnetizations, but also second moments, specifically two-time correlations and responses for each degree of freedom. The end result is an effective equation of motion for each single degree of freedom, where couplings to other variables appear as a self-coupling to the past (i.e. memory term) and a coloured noise. This constitutes a new mean field approximation that should become exact in the thermodynamic limit of a large network, for suitably long-ranged couplings. For the analytically tractable case of linear dynamics we establish this exactness explicitly by appeal to spectral methods of Random Matrix Theory, for Gaussian couplings with arbitrary degree of symmetry.

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