

# Berlin Center for Studies of Complex Chemical Systems

Fritz-Haber-Institut der Max-Planck-Gesellschaft, Humboldt-Universität, Max-Delbrück-Centrum für Molekulare Medizin, Otto-von-Guericke-Universität Magdeburg, Physikalisch-Technische Bundesanstalt, Technische Universität Berlin, Universität Potsdam.

Seminar

## Complex Nonlinear Processes in Chemistry and Biology

*Honorary Chairman: G. Ertl.*

*Organizers: M. Bär, C. Beta, H. Engel, M. Falcke, M. J. B. Hauser, J. Kurths, A. S. Mikhailov, P. Plath, L. Schimansky-Geier, and H. Stark.*

Friday, 9th November, 2012, 16:00 s.t.

**Address:** Richard-Willstätter-Haus, Faradayweg 10, 14195 Berlin, U-Bahnhof Thielplatz (U3).

Dr. Gasper Tkacik

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### Information transmission in biological regulatory networks: lessons from early development

Positional information -- the property of morphogen expression patterns that enables cells in a developing embryo to learn about their position solely by local concentration measurements -- is central to our understanding of the developmental process. Nevertheless, it has neither been defined mathematically nor quantified in a principled way. Here we provide an information-theoretic definition of positional information, discuss which features of expression patterns can increase or decrease it, and present inference tools to estimate it from experimental data.

Using this formalism in a theoretical setting, we can ask what kinds of regulatory networks would optimize the encoding of positional information. This allows us to predict, rather than fit from data, the patterns of gap gene expression that qualitatively recapitulate those observed in the fruit fly, *Drosophila melanogaster*.