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# Fluctuation relations, gradient flows, and the GENERIC formalism

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When looking at a dynamical system, it is usually difficult to guess the shape of its long-time dynamics: will it reach a fixed point, limit cycle, or other strange attractor, or will it break free and fly away to infinity? Gradient flows are a very special class among those, which always roll down the slope of some potential (or negative entropy) until they reach a minimum, where they then sit forever. The Generalised Equation for Non-Equilibrium Reversible-Irreversible Coupling (GENERIC) defines a slightly more eventful class of systems, which still evolve to maximise an entropy, but also conserve some energy, and retain some kinetics in their steady state. A natural source of gradient flows is the deterministic trajectories of low-noise detail-balanced stochastic systems, which is a direct consequence of the traditional time-reversal fluctuation relation that they verify in relation to the gradient of their entropy. In this talk, we will see that the same goes for GENERIC: it emerges quite simply from another fairly natural (but less ubiquitous) fluctuation relation, where time-reversal is performed around a non-zero drift. We will describe the consequences of that symmetry, as well as the class of systems that bear it, and give a few classic examples for illustration.

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