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Three-scale analysis of nonlocal Fokker-Planck equations

Modern Lithium-ion batteries can be modelled by nonlocal Fokker-Planck equations that (i) describe energy minimisation in a double well-potential, (ii) involve two small parameters, (iii) are driven by a time-dependent constraint. The dynamics of such equations take place on three different times scales and can produce several types of hysteretic or non-hysterectic phase transitions. In this talk we identify four different parameter regimes and derive reduced dynamical models for the corresponding small parameter limits. In particular, we show that hysteric phase transitions are governed by Kramers formula (fast reaction regime) or delayed bifurcations (slow reaction regime). This is joint work with Barbara Niethammer and Juan Velazquez.