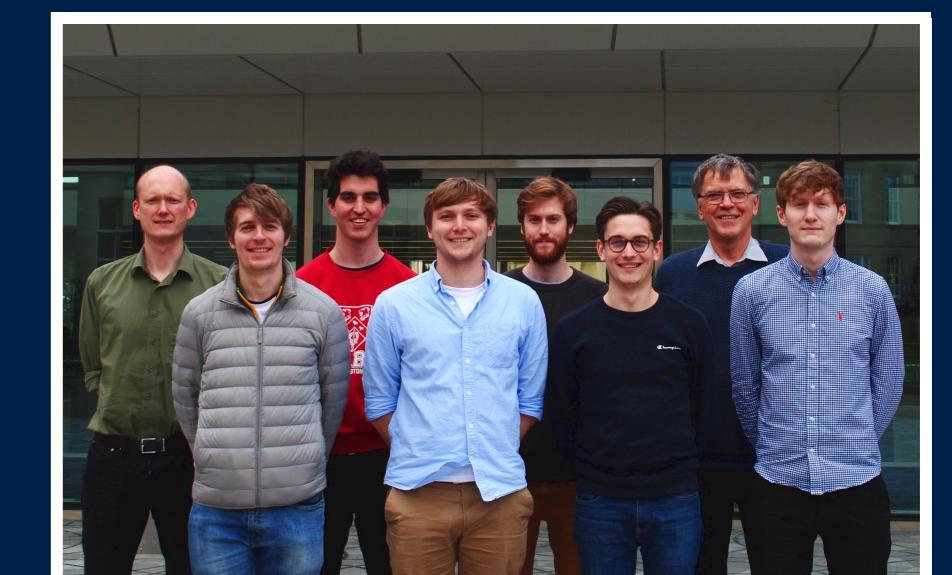


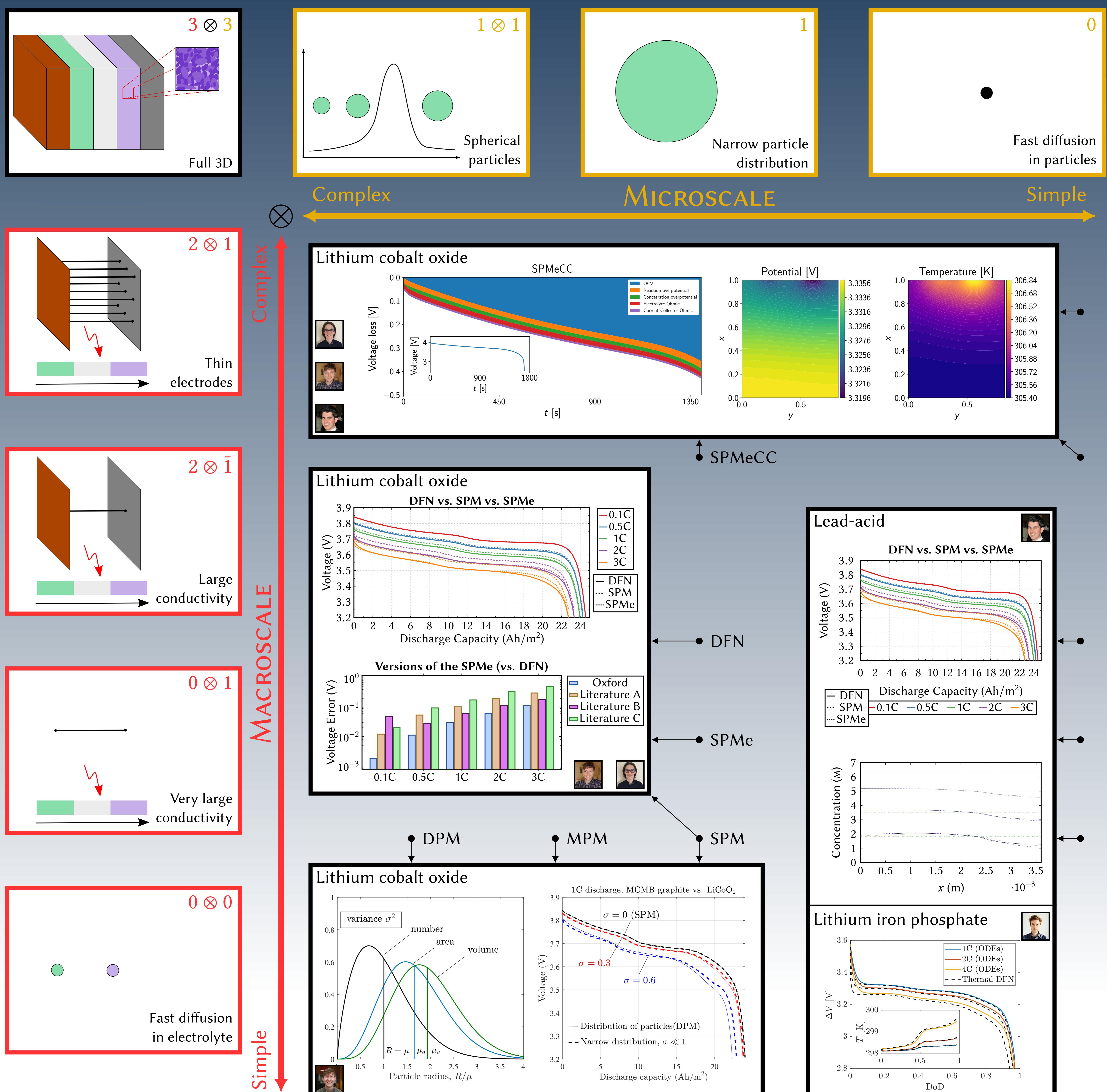


An Asymptotic Framework for Battery Modelling



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Electrochemical and equivalent-circuit modelling are the two most popular approaches to battery simulation, but the former is computationally expensive and the latter provides limited physical insight. Through asymptotic analysis, we systematically derive simplified physics-based models, which provide a useful theoretical middle ground to support battery management, on-line diagnostics, and cell design. Combinations of simplifications to the **macroscale** and **microscale** result in a suite of reduced-order models, whose complexity and fidelity can be selected to best meet the user's needs. The approach taken provides a general framework for developing reduced-order models which is independent of chemistry, and can be extended to incorporate additional physical effects such as mechanics, side reactions and degradation mechanisms. We are currently developing the software package PyBaMM to implement the suite of models numerically.



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