Initial data for general-relativistic simulations of charged black holes

Einstein-Maxwell theory has fascinated theoretical physicists for decades. One of the reasons for this is that the theory involves two of the four fundamental forces: electromagnetism and gravity. However, the theory has been mostly confined to the realm of theoretical investigation because astrophysically relevant black holes are thought to have negligible electric charge.
This theory has also been studied primarily with analytical tools, which is why the vast majority of available results are only for spacetimes endowed with some degree of symmetry (e.g. stationarity and axisymmetry).
As a result, dynamical, electrovacuum spacetimes, where the numerical approach is the only feasible one, represent a largely unexplored territory. An example of such systems is the coalescence and merger of charged black holes. In this talk we present our efforts to tackle this problem.
As a first step, we numerically solve the constraint equations to generate valid initial data for dynamical spacetime, general-relativistic simulations of binary black holes that possess electric charge, linear and angular momenta. The initial data are constructed within the conformal transverse-traceless approach, and the black holes are described within a modified Bowen-York framework. The attribution of physical parameters (mass, charge and momenta) to the holes is performed by adopting the dynamical horizon formalism. Finally, we present some first numerical results.

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