Dynamical spacetimes in Einstein-Maxwell-dilaton theory and cosmic censorship

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ABSTRACT

I will discuss spherically symmetric —but time-dependent— solutions of the Einstein-Maxwell-dilaton system. This theory arises in low-energy effective string theory and supports well known stationary black hole solutions, but little is known about their non-stationary counterparts. New exact dynamical solutions, including the dyonic case, will be presented. They are obtained from previously known static solutions by promoting conserved charges to be functions of time. Generically, these Vaidya-like spacetimes are supported by charged null dust, but for the specific heterotic string value of the dilaton coupling one finds time-dependent vacuum solutions. The causal structure of these spacetimes is clarified and applications to cosmic censorship and critical collapse are considered. Focusing on self-similar solutions, it is shown that they describe the collapse of charged null dust leading to the formation of a black hole or a naked singularity, depending on the charge-to-energy ratio of the source. Near the threshold, the black hole mass is controlled by a power law, whose exponent can be computed analytically.

References

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