Classification Theorem for the Static and Asymptotically Flat Einstein-Maxwell-Dilaton Spacetimes Possessing a Photon Sphere

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ABSTRACT

We consider the classification problem for the static and asymptotically flat solutions to the Einstein-Maxwell-dilaton equations with a photon sphere. First we prove that the photon sphere has constant mean and scalar curvatures. Then we derive some equations relating the mean curvature with the physical characteristics of the photon sphere. Next we show that there is a functional dependence between the lapse function, the electrostatic potential and the dilaton field. With this information we are able to explicitly construct the Einstein-Maxwell-dilaton solutions with a non-extremal photon sphere and prove the main theorem.