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Extreme Black Hole Anabasis

We study the SL(2) transformation properties of spherically symmetric perturbations of the Bertotti-Robinson universe and identify an invariant μ that characterizes the backreaction of these linear solutions. The only backreaction allowed by Birkhoff's theorem is one that destroys the $AdS_2 \times S^2$ boundary and builds the exterior of an asymptotically flat Reissner-Nordstrom black hole with $Q = M\sqrt{1 - \mu/4}$. We call such backreaction with boundary condition change an *anabasis*. We show that the addition of linear anabasis perturbations to Bertotti-Robinson may be thought of as a boundary condition that defines a *connected* $AdS_2 \times S^2$. The connected AdS_2 is a nearly-AdS_2 with its SL(2) broken appropriately for it to maintain connection to the asymptotically flat region of Reissner-Nordstrom. We perform a backreaction calculation with matter in the connected $AdS_2 \times S^2$ and show that it correctly captures the dynamics of the asymptotically flat black hole.