

On the Generalization of the Kruskal-Szekeres Coordinates: A Global Conformal Charting of the Reissner–Nordstrom Spacetime

The Kruskal-Szekeres coordinates construction for the Schwarzschild spacetime could be viewed geometrically as a squeezing of the t -line associated with the asymptotic observer into a single point, at the event horizon $r = 2M$. Starting from this point, we extend the Kruskal charting to spacetimes with two horizons, in particular the Reissner-Nordström manifold, \mathcal{M}_{RN} . We develop a new method for constructing Kruskal-like coordinates and find two algebraically distinct classes charting \mathcal{M}_{RN} . We pedagogically illustrate the success of our method by constructing two compact, conformal, and global coordinate systems labeled $\mathcal{G}\mathcal{K}_{\mathcal{I}}$ and $\mathcal{G}\mathcal{K}_{\mathcal{II}}$ for each class respectively. In both coordinates, the metric differentiability can be promoted to C^∞ . The conformal metric factor can be explicitly written in terms of the original t and r coordinates for both charts.

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