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The Common Solution Space of General Relativity

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We review the solution space for the field equations of Einstein's General Relativity for various static, spherically symmetric spacetimes. We consider the vacuum case, represented by the Schwarzschild black hole; the de Sitter-Schwarzschild geometry, which includes a cosmological constant; the Reissner-Nordström geometry, which accounts for the presence of charge. Additionally we consider the homogenenous and anisotropic locally rotational Bianchi II spacetime in the vacuum. For the aforementioned gravitational models can be expressed in the equivalent form of the null geodesic equations for conformally flat geometries. Consequently, the solution space for the field equations is common, and it is the solution space for the free particle in a flat space. This approach open new directions on the construction of analytic solutions in gravitational physics and cosmology.

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