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Robinson-Trautman spacetimes in the Einstein-Gauss-Bonnet theory

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We derive the explicit form of the Einstein-Gauss-Bonnet field equations for D-dimensional geometries that admit non-twisting, shear-free, and expanding null geodesic congruences, forming thus the famous Robinson-Trautman class of spacetimes, and discuss their structure and particular solutions. In D=4 GR, this class contains Weyl type II spacetimes or algebraically more special solutions such as spherical black holes or exact type N gravitational waves; however, in D>4, there are only Weyl type D solutions. Examining the RT class within the EGB could indicate whether this discrepancy arises from gravitational theory or the behaviour of the higher-dimensional RT geometries themselves.

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