References

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L. Mason: A new programme for light cone cuts and Yang-Mills holonomies

Appendix: explicit coordinate expressions

One of the main features of the Kozameh-Newman formalism is the use of the 4 functions $Z^{AA'} = \partial^A \partial^{A'} Z$ at some fixed $\pi^A$, $\pi_A$ as coordinates on $\mathcal{M}$. The 0th and 1st derivatives of $Z$ are determined from $Z^{AA'}$ by $Z = \pi_A \pi_A Z^{AA'}$ and $Z^{A'} = \pi_A Z^{AA'}$ (these follow from the homogeneity of $Z$) so $Z^{AA'}$ is the part of the second jet of $Z$ as a function of $\pi_A$, $\pi_A$ containing only the mixed second derivatives. In flat space $Z$ can be taken to be $Z = x^{AA'} \pi_A \pi_A$ where $x^{AA'}$ are affine coordinates on Minkowski space, so $Z^{AA'} = x^{AA'}$.

Note that if a quantity $f$ has homogeneity $n$ in $\pi_A$, then $\pi_A \partial^A \partial^{A'} \partial^n f = 0$ by homogeneity so that $\partial^A \partial^{A'} \partial^n f = x^A x^{A'} x^n \partial^{n+1} f$ for some quantity $\partial^{n+1} f$ of weight $-n-2$. Transferring $A = B^2 Z$, and $A^A = B^A B^2 Z$ to the $Z^{AA'}$ coordinate system, we find that $\star$ becomes:

$$0 = g^{A(A'B')B} + x^A x^B x^C \partial_C \partial_D (A^A g^{B}) \partial_D + x^A x^B x^C \partial_C \partial_D A^A (A^A g^{B}) \partial_D$$

$$+ \frac{1}{2} x^A x^B x^C \partial_C \partial_D g^{B} d^2 \partial_Z + \partial_Z \partial_D \partial_C \partial_D \partial_D \partial_C \partial_D \partial_D d^2$$

where $\epsilon$, $d$ are the concrete indices associated to the $Z^{AA'}$ coordinate system; $\epsilon = CC'$ etc.. If we adjoin to this the equation $g^{A(A'B')B} = \Omega^2 e^{AB} \epsilon^{A'B'}$ where $\Omega$ is the undetermined conformal factor, one can solve for $g^{ab}$ provided $(x^A x^A \partial_{AA'} A^A x^A x^A \partial_{AA'} A^A) \neq 1.$