Oppenheim’s “Postquantum Gravity”

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We intent to derive Oppenheim’s post-quantum gravity [1] by just adding a bit of a jitter to Einstein’s General Theory of Relativity [2] in the simplest form, namely, as an eigenequation as follows:

$$\hat{F}\cdot G_{\alpha\beta}=F\cdot G_{\alpha\beta}=F\cdot\left(R_{\alpha\beta}-R\frac{g_{\alpha\beta}}{2}\right)=\frac{8\pi G}{c^{4}}\hat{T}_{\alpha\beta}[F]. \tag{1}$$

We start with the following scaled metric tensor and force it into the Einstein-Hilbert action [3] variational process as follows:

$$\Gamma_{\alpha\beta}=g_{\alpha\beta}\cdot F[f]\quad\rightarrow\quad\delta W=0=\delta\int_{V}d^{n}x\sqrt{-\Gamma}\cdot R^{*} \tag{2}$$

Here Γ denotes the determinant of the metric tensor from (2) and R^* gives the corresponding Ricci scalar. Performing the variation with respect to the metric $\Gamma_{\alpha\beta}$ and a bit of shaping results in:

$$F\cdot\boxed{G_{\alpha\beta}}=\frac{1}{2}\left(\begin{array}{c}\left(\begin{array}{c}F_{,\alpha\beta}(n-2)+F_{,ab}g_{\alpha\beta}g^{ab}+F_{,a}g^{ab}\left(g_{\beta b,\alpha}-g_{\beta\alpha,b}\right)-\\ F_{,\alpha}g^{ab}g_{\beta b,a}-F_{,\beta}g^{ab}g_{\alpha b,a}+\frac{F_{,d}g^{cd}}{2}\left(\begin{array}{c}n\left(g_{\alpha\beta,c}-g_{\alpha c,\beta}-g_{\beta c,\alpha}\right)\\ +2g_{\alpha c,\beta}+g_{\alpha\beta}g_{ab,c}g^{ab}\end{array}\right)\end{array}\right)\\ -\frac{1}{2F}\left(F_{,\alpha}\cdot F_{,\beta}(3n-6)+g_{\alpha\beta}F_{,c}F_{,d}g^{cd}(4-n)\right)\\ -(n-1)\left(\left(\begin{array}{c}2\Delta F-2F_{,d}g^{cd}{}_{,c}\\ -\frac{n}{(n-1)}F_{,d}g^{cd}g^{ab}g_{ac,b}\end{array}\right)+\frac{g^{ab}F_{,a}\cdot F_{,b}}{2F}(n-6)\right)\frac{g_{\alpha\beta}}{2}\end{array}\right) \tag{3}$$

gives us the required structure (1) in its proper expanded form. Hence, we have obtained a post-quantized gravity right out of our quantum gravity approach of a scaled metric tensor (2), thereby sticking to the classical Hilbert variation [3]. We recognize the gravity part (boxed term on the left) and the quantum terms [4 - 8] on the righthand side.

References

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