The "Legendre scalarization" of nonlinear gravity theories

LQr- i?2 p `B LiBQM `X7 iQ i?2 K2i`B+ ;Bp2b UBM i?2 b2[m2H $L_{EL}$ r `X7 iQ
iQ /2MQi2 $R(B)M$#v r - iQ pQB/ KBbmM/2`bi M/BM;bV

$$R \quad \frac{1}{2}Rg \;=\; \frac{1}{2}\; r \quad f(r)\; g \quad \frac{1}{2}r \quad r \quad + \frac{1}{4}r \quad r \quad g \quad + T^{(mat)} \qquad UkyV$$

r?BH2 i?2 p `B iBQM r `X iQ

$$2 \;=\; r: \qquad UkRV$$

`2 i?2b2 2[m iBQMb 2[mBp H2Mi iQ UkV\ Ai QM2 i F2b 7
$p = f^0(R(g))$ - i?2 (M ;) `2 2t +iHv i?2 b K2 (g p ; p) Q#+ +m` `BM;
BM UR3VX h?mb- bBM+2 Bi ? b #22M T`Qp2M i? i UkV Bb 2[m
UR3V- i?2 2[m iBQMb #Qp2 b?QmH/ #2 2[mBp H2Mi iQ UR3V
h?2 i`Qm#H2 Bb i? i i?2 p `B iBQM Q7 L_{EL} r `X i iQ; bM;B M
MQi B2H/ i?2 2[m iBQM $R(g) = r$ - bQ i?2 `2H iBQM $= f^0(R(g))$ + MMQi #2
/2`Bp2/ 7`QK i?2 }2H/ 2[m iBQMb UBM +QMi` bi iQ UR3V- r?2
#2 `2+Qp2`2/ #v +QK#BMBM; i?2 b2+QM/ 2[m iBQM rBi? i?2
2[m iBQMVX q2 QMHv FMQr- #v i?2 / 2;(M) BiBQM Q7
A7 Bi r2`2 i`m2 i? $R(g) = r(i)$ U M/ 2[mBp H2Mi $= f^0(R(g))$V QM HH bQ@
HmiBQMb Q7 i?2 }2H/ 2[m iBQMb $f^0(R) = R$ - M/ bBM+2 i?2 iQ `2H /2`Bp2
i?2 i` +2 Q7 UkV QM2 }M/b $= \frac{2}{3}f(R) = \frac{1}{3}f^0(R)R + \frac{1}{3}T^{(mat)}$ g X
6Q` BMbi M+2- H2i mb +?2+F r?2i?2` $f(R) = R + R^2$ BM/2+2 Bb +
Bb +QMbB/2`2/ #v i?2 mi?Q`b BM i?2 bm#b2[m2Mi b2+iBQM
i?2 p +mmK + b2- 7Q` bBKTHB+Biv- r(V X = AM i?2 / b2 QM2 ? b
1BMbi2BM@G2;2M/`2 G ;` M;B M #2+QK2b

$$L_{EL} = \quad R(g) + \frac{(\quad 1)^2}{4} + \frac{1}{2}g \quad r \quad r \qquad p\,\overline{jgj}; \qquad UkkV$$

?2M+2 QM2 }M/b i?2 2[m iBQMb

$$R \quad \frac{1}{2}Rg \;=\; \frac{(\quad 1)^2}{8}g \quad \frac{1}{2}r \quad r \quad + \frac{1}{4}r \quad r \quad g \qquad UkjV$$

M/

$$2 \;=\; \frac{1}{2}: \qquad Uk9V$$

h FBM; i?2 i` +2 Q7 UkjV QM2 }M/b

$$R = \frac{1}{4}r \quad r \quad + \frac{(\quad 1)^2}{2} \qquad Uk8V$$

r?B+? Bb +QKT iB#H2 QMHv 7Q` $R = \frac{1}{2}$ BM Hv BMHHb i?2 }`bi Q`/2` 2[m iBQ
$r \quad r \quad = \frac{2}{\,}(\quad 1)(\quad 2)$ - r?B+? /Q2b MQi ?QH/ BM ;2M2` H 7Q` bQH

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