$$\dot{g} = \left[\begin{array}{c|c|c|c} 1 & 0 & 0 & 0 \\ \hline 0 & -R_t^2 & 0 & 0 \\ \hline 0 & 0 & -R_t^2 f_\omega^2 & 0 \\ \hline 0 & 0 & 0 & -R_t^2 f_\omega^2 s_\vartheta^2 \end{array}\right] = \left[\begin{array}{c|c|c|c} 1 & 0 & 0 & 0 \\ \hline 0 & -R^2 & 0 & 0 \\ \hline 0 & 0 & -R^2 f^2 & 0 \\ \hline 0 & 0 & 0 & -R^2 f^2 s^2 \end{array}\right]$$

$$\dot{g}^{-1} = \left[\begin{array}{c|c|c|c} 1 & 0 & 0 & 0 \\ \hline 0 & -R^{-2} & 0 & 0 \\ \hline 0 & 0 & -R^{-2} f^{-2} & 0 \\ \hline 0 & 0 & 0 & -R^{-2} f^{-2} s^{-2} \end{array}\right]$$

$$\bar{\partial} \otimes \dot{g} = \begin{array}{c|c|c|c|c} \partial_t & 1 & 0 & 0 & 0 \\ \hline \partial_\omega & 0 & -R^2 & 0 & 0 \\ \hline \partial_\vartheta & 0 & 0 & -R^2 f^2 & 0 \\ \hline \partial_\varphi & 0 & 0 & 0 & -R^2 f^2 s^2 \end{array} = \begin{array}{c|cccc} \partial_t & 1 & 0 & 0 & 0 \\ & 0 & -R^2 & 0 & 0 \\ & 0 & 0 & -R^2 f^2 & 0 \\ & 0 & 0 & 0 & -R^2 f^2 s^2 \\ \hline \partial_\omega & 1 & 0 & 0 & 0 \\ & 0 & -R^2 & 0 & 0 \\ & 0 & 0 & -R^2 f^2 & 0 \\ & 0 & 0 & 0 & -R^2 f^2 s^2 \\ \hline \partial_\vartheta & 1 & 0 & 0 & 0 \\ & 0 & -R^2 & 0 & 0 \\ & 0 & 0 & -R^2 f^2 & 0 \\ & 0 & 0 & 0 & -R^2 f^2 s^2 \\ \hline \partial_\varphi & 1 & 0 & 0 & 0 \\ & 0 & -R^2 & 0 & 0 \\ & 0 & 0 & -R^2 f^2 & 0 \\ & 0 & 0 & 0 & -R^2 f^2 s^2 \end{array} = -2R \begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & \bar{R} & 0 & 0 \\ 0 & 0 & \bar{R} f^2 & 0 \\ 0 & 0 & 0 & \bar{R} f^2 s^2 \\ \hline 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & R f \bar{f} & 0 \\ 0 & 0 & 0 & R f \bar{f} s^2 \\ \hline 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & R f^2 s c \\ \hline 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array}$$

$$
\frac{\begin{matrix} 1 & 0 & 0 & 0 \\ 0 & \bar{R} & 0 & 0 \\ 0 & 0 & \bar{R}f^2 & 0 \\ 0 & 0 & 0 & \bar{R}f^2s^2 \end{matrix}}{\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & Rf\bar{f} & 0 \\ 0 & 0 & 0 & Rf\bar{f}s^2 \end{matrix}}
\frac{\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & Rf^2sc \end{matrix}}{\begin{matrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{matrix}}
-
\frac{\begin{matrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{matrix}}{\begin{matrix} 1 & 0 & 0 & 0 \\ \bar{R} & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix}}
\frac{\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ \bar{R}f^2 & Rf\bar{f} & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix}}{\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ \bar{R}f^2s^2 & Rf\bar{f}s^2 & Rf^2sc & 0 \end{matrix}}
+
\frac{\begin{matrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{matrix}}{\begin{matrix} 0 & \bar{R} & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix}}
\frac{\begin{matrix} 0 & 0 & \bar{R}f^2 & 0 \\ 0 & 0 & Rf\bar{f} & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix}}{\begin{matrix} 0 & 0 & 0 & \bar{R}f^2s^2 \\ 0 & 0 & 0 & Rf\bar{f}s^2 \\ 0 & 0 & 0 & Rf^2sc \\ 1 & 0 & 0 & 0 \end{matrix}}
$$

$$
= \frac{\begin{matrix} 1 & 0 & 0 & 0 \\ 0 & \bar{R} & 0 & 0 \\ 0 & 0 & \bar{R}f^2 & 0 \\ 0 & 0 & 0 & \bar{R}f^2s^2 \end{matrix}}{\begin{matrix} 0 & \bar{R} & 0 & 0 \\ -\bar{R} & 0 & 0 & 0 \\ 0 & 0 & Rf\bar{f} & 0 \\ 0 & 0 & 0 & Rf\bar{f}s^2 \end{matrix}}
\frac{\begin{matrix} 0 & 0 & \bar{R}f^2 & 0 \\ 0 & 0 & Rf\bar{f} & 0 \\ -\bar{R}f^2 & -Rf\bar{f} & 0 & 0 \\ 0 & 0 & 0 & Rf^2sc \end{matrix}}{\begin{matrix} 0 & 0 & 0 & \bar{R}f^2s^2 \\ 0 & 0 & 0 & Rf\bar{f}s^2 \\ 0 & 0 & 0 & Rf^2sc \\ -\bar{R}f^2s^2 & -Rf\bar{f}s^2 & -Rf^2sc & 0 \end{matrix}}
= -\frac{1}{2R}\left(\text{ } - \text{ } + \text{ } \right)
$$

$$\Lambda = \frac{1}{2}\underbrace{\bar{\Upsilon}\Sigma\Upsilon - \bar{\Upsilon}^{T}\Sigma\Upsilon + \bar{\Upsilon}^{Tt}\Sigma\Upsilon}\ \bar{\Lambda}^{-1} =$$

$$\left(\begin{array}{cccc}
1 & 0 & 0 & 0 \\
0 & \bar{R} & 0 & 0 \\
0 & 0 & \bar{R}f^{2} & 0 \\
0 & 0 & 0 & \bar{R}f^{2}s^{2}
\end{array}\right)$$

$$\left(\begin{array}{cccc}
0 & \bar{R} & 0 & 0 \\
-\bar{R} & 0 & 0 & 0 \\
0 & 0 & Rff & 0 \\
0 & 0 & 0 & R\bar{f}fs^{2}
\end{array}\right)$$

$$-R\left(\begin{array}{cccc}
0 & 0 & \bar{R}f^{2} & 0 \\
0 & 0 & R\bar{f}f & 0 \\
-\bar{R}f^{2} & -R\bar{f}f & 0 & 0 \\
0 & 0 & 0 & Rf^{2}sc
\end{array}\right)$$

$$\left(\begin{array}{cccc}
0 & 0 & 0 & \bar{R}f^{2}s^{2} \\
0 & 0 & 0 & R\bar{f}fs^{2} \\
0 & 0 & 0 & R\bar{f}^{2}sc \\
-\bar{R}f^{2}s^{2} & -R\bar{f}fs^{2} & -Rf^{2}sc & 0
\end{array}\right)$$

$$\left(\begin{array}{c|c|c|c}
1 & 0 & 0 & 0 \\
\hline
0 & -R^{-2} & 0 & 0 \\
\hline
0 & 0 & -R^{-2}f^{-2} & 0 \\
\hline
0 & 0 & 0 & -R^{-2}f^{-2}s^{-2}
\end{array}\right)$$

$$
\left[\begin{array}{cccc|cccc}
1 & 0 & 0 & 0 & -R & 0 & 0 & 0 \\
0 & \bar{R} & 0 & 0 & 0 & R^{-1} & 0 & 0 \\
0 & 0 & \bar{R}f^2 & 0 & 0 & 0 & R^{-1}f^{-2} & 0 \\
0 & 0 & 0 & \bar{R}f^2s^2 & 0 & 0 & 0 & R^{-1}f^{-2}s^{-2} \\
\hline
0 & \bar{R} & 0 & 0 & -R & 0 & 0 & 0 \\
-\bar{R} & 0 & 0 & 0 & 0 & R^{-1} & 0 & 0 \\
0 & 0 & Rff & 0 & 0 & 0 & R^{-1}f^{-2} & 0 \\
0 & 0 & 0 & Rffs^2 & 0 & 0 & 0 & R^{-1}f^{-2}s^{-2} \\
\hline
0 & 0 & \bar{R}f^2 & 0 & -R & 0 & 0 & 0 \\
0 & 0 & Rff & 0 & 0 & R^{-1} & 0 & 0 \\
-\bar{R}f^2 & -Rff & 0 & 0 & 0 & 0 & R^{-1}f^{-2} & 0 \\
0 & 0 & 0 & Rf^2sc & 0 & 0 & 0 & R^{-1}f^{-2}s^{-2} \\
\hline
0 & 0 & 0 & \bar{R}f^2s^2 & -R & 0 & 0 & 0 \\
0 & 0 & 0 & Rffs^2 & 0 & R^{-1} & 0 & 0 \\
0 & 0 & 0 & Rf^2sc & 0 & 0 & R^{-1}f^{-2} & 0 \\
-\bar{R}f^2s^2 & -Rffs^2 & -Rf^2sc & 0 & 0 & 0 & 0 & R^{-1}f^{-2}s^{-2}
\end{array}\right]
=
\left[\begin{array}{cccc}
1 & 0 & 0 & 0 \\
0 & \bar{R}/R & 0 & 0 \\
0 & 0 & \bar{R}/R & 0 \\
0 & 0 & 0 & \bar{R}/R \\
\hline
0 & \bar{R}/R & 0 & 0 \\
\bar{R}R & 0 & 0 & 0 \\
0 & 0 & f/f & 0 \\
0 & 0 & 0 & f/f \\
\hline
0 & 0 & \bar{R}/R & 0 \\
0 & 0 & f/f & 0 \\
\bar{R}Rf^2 & -ff & 0 & 0 \\
0 & 0 & 0 & c/s \\
\hline
0 & 0 & 0 & \bar{R}/R \\
0 & 0 & 0 & f/f \\
0 & 0 & 0 & c/s \\
\bar{R}Rf^2s^2 & -ffs^2 & -sc & 0
\end{array}\right]
$$

$$\underline{\curvearrowleft} \bowtie \overset{\sharp}{\curvearrowright} =$$

$$\begin{array}{c|cccc|cccc|cccc|cccc}
\partial_t & 1 & 0 & 0 & 0 & 0 & \bar{R}/R & 0 & 0 & 0 & 0 & \bar{R}/R & 0 & 0 & 0 & 0 & \bar{R}/R \\
\partial_\omega & 0 & \bar{R}/R & 0 & 0 & \bar{R}R & 0 & 0 & 0 & 0 & 0 & \underline{f}/f & 0 & 0 & 0 & 0 & \underline{f}/f \\
\partial_\vartheta & 0 & 0 & \bar{R}/R & 0 & 0 & 0 & \underline{f}/f & 0 & \bar{R}Rf^2 & -\underline{f}f & 0 & 0 & 0 & 0 & 0 & c/s \\
\partial_\varphi & 0 & 0 & 0 & \bar{R}/R & 0 & 0 & 0 & \underline{f}/f & 0 & \bar{0} & 0 & c/s & \bar{R}Rf^2s^2 & -\underline{f}fs^2 & -sc & 0
\end{array}$$

$$=$$

$$\begin{array}{c|cccc|cccc|cccc|cccc}
 & 0 & 0 & 0 & 0 & 0 & \overline{\bar{R}/R} & 0 & 0 & 0 & 0 & \overline{\bar{R}/R} & 0 & 0 & 0 & 0 & \overline{\bar{R}/R} \\
 & & & & & \overline{\bar{R}R} & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
 & & & * & & 1 & 0 & 0 & 0 & \overline{\bar{R}Rf^2} & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
 & & & & & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & \overline{\bar{R}Rf^2s^2} & 0 & 0 & 0 \\
\hline
 & 0 & 0 & 0 & 0 & & & & & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
 & 0 & 0 & 0 & 0 & & & & & 0 & 0 & \underline{f}/f & 0 & 0 & 0 & 0 & \underline{f}/f \\
 & 0 & 0 & 0 & 0 & & & * & & & & \overline{\underline{f}/f} & & 1 & 0 & 0 & \overline{0} \\
 & 0 & 0 & 0 & 0 & & & & & 2\bar{R}Rf\underline{f} & -\underline{f}f & 0 & 0 & & & & \\
 & 0 & 0 & 0 & 0 & & & & & 1 & \overline{\underline{0}} & 0 & 0 & 2\bar{R}R\underline{f}fs^2 & -\underline{f}\underline{f}s^2 & 0 & 0 \\
\hline
 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & & & & & 1 & 0 & 0 & 0 \\
 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & & & & & 1 & 0 & 0 & 0 \\
 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & & & * & & 0 & 0 & 0 & -s^{-2} \\
 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & & & & & 2\bar{R}Rf^2sc & -2\underline{f}fsc & s^2-c^2 & 0 \\
\hline
 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{array}$$

$$
\begin{array}{c}
\begin{array}{cccc}
1 & 0 & 0 & 0 \\
0 & \bar{R}/R & 0 & 0 \\
0 & 0 & \bar{R}/R & 0 \\
0 & 0 & 0 & \bar{R}/R
\end{array} \\
\hline
\begin{array}{cccc}
0 & \bar{R}/R & 0 & 0 \\
\bar{R}R & 0 & 0 & 0 \\
0 & 0 & \underline{f}/f & 0 \\
0 & 0 & 0 & \underline{f}/f
\end{array} \\
\hline
\begin{array}{cccc}
0 & 0 & \bar{R}/R & 0 \\
0 & 0 & \underline{f}/f & 0 \\
\bar{R}Rf^2 & -\underline{f}f & 0 & 0 \\
0 & \bar{0} & 0 & c/s
\end{array} \\
\hline
\begin{array}{cccc}
0 & 0 & 0 & \bar{R}/R \\
0 & 0 & 0 & \underline{f}/f \\
0 & 0 & 0 & c/s \\
\bar{R}Rf^2s^2 & -\underline{f}fs^2 & -sc & 0
\end{array}
\end{array}
$$

$$
\left[\begin{array}{cccc}
1 & 0 & 0 & 0 \\
0 & \bar{R}/R & 0 & 0 \\
0 & 0 & \bar{R}/R & 0 \\
0 & 0 & 0 & \bar{R}/R
\end{array}\right]
\left[\begin{array}{cccc}
0 & \bar{R}/R & 0 & 0 \\
\bar{R}R & 0 & 0 & 0 \\
0 & 0 & \underline{f}/f & 0 \\
0 & 0 & 0 & \underline{f}/f
\end{array}\right]
\left[\begin{array}{cccc}
0 & 0 & \bar{R}/R & 0 \\
0 & 0 & \underline{f}/f & 0 \\
\bar{R}Rf^2 & -\underline{f}f & 0 & 0 \\
0 & \bar{0} & 0 & c/s
\end{array}\right]
\left[\begin{array}{cccc}
0 & 0 & 0 & \bar{R}/R \\
0 & 0 & 0 & \underline{f}/f \\
0 & 0 & 0 & c/s \\
\bar{R}Rf^2s^2 & -\underline{f}fs^2 & -sc & 0
\end{array}\right]
$$

$$
=
$$

$$
\begin{array}{|cccc|cccc|cccc|ccc|}
\multicolumn{4}{|c|}{*} & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
 & & & & \bar{R}^2 & 0 & 0 & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & 0 & 0 & 0 \\
 & & & & 0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & \bar{R}^2\bar{f}^2 & \frac{\bar{R}ff}{\bar{-R}} & 0 & 0 & 0 & 0 & 0 \\
 & & & & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & 0 & 0 & \frac{\bar{R}c}{Rs} & \bar{R}^2\bar{f}^2\bar{s}^2 & \frac{\bar{R}f\bar{f}\bar{s}^2}{\bar{-R}} & \frac{\bar{R}sc}{\bar{-R}} \\
\hline
0 & \frac{\bar{R}^2}{\bar{R}^2} & 0 & 0 & \multicolumn{4}{c|}{} & 0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & \multicolumn{4}{c|}{} & 0 & 0 & \bar{R}^2 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & \multicolumn{4}{c|}{*} & \bar{R}\bar{R}ff & \bar{-f}^2 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\bar{R}f}{\bar{R}f} & \multicolumn{4}{c|}{} & 0 & 0 & 0 & \frac{fc}{\bar{f}s} & \bar{R}\bar{R}ff\bar{s}^2 & \bar{-f}^2\bar{s}^2 & \frac{fsc}{\bar{-f}} \\
\hline
0 & 0 & \frac{\bar{R}^2}{R^2} & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & \multicolumn{4}{c|}{} & 0 & 0 & 0 \\
0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & 0 & 0 & \frac{f^2}{\bar{f}^2} & 0 & \multicolumn{4}{c|}{} & 0 & 0 & 0 \\
0 & \frac{\bar{R}ff}{\bar{-R}} & 0 & 0 & -\bar{R}\bar{R}ff & \bar{R}^2\bar{f}^2 & 0 & 0 & \multicolumn{4}{c|}{*} & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\bar{R}c}{Rs} & 0 & 0 & 0 & \frac{fc}{\bar{f}s} & \multicolumn{4}{c|}{} & \bar{R}\bar{R}\bar{f}sc & \bar{-f}fsc & \bar{-c}^2 \\
\hline
0 & 0 & 0 & \frac{\bar{R}^2}{\bar{R}^2} & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & 0 & 0 & \frac{\bar{R}c}{Rs} & \multicolumn{3}{c|}{} \\
0 & 0 & 0 & \frac{\bar{R}f}{\bar{R}f} & 0 & 0 & 0 & \frac{f^2}{\bar{f}^2} & 0 & 0 & 0 & \frac{fc}{\bar{f}s} & \multicolumn{3}{c|}{} \\
0 & 0 & 0 & \frac{\bar{R}c}{Rs} & 0 & 0 & 0 & \frac{fc}{\bar{f}s} & 0 & 0 & 0 & \frac{\bar{c}^2}{\bar{s}^2} & \multicolumn{3}{c|}{*} \\
0 & \frac{\bar{R}f\bar{f}\bar{s}^2}{\bar{-R}} & \frac{\bar{R}sc}{\bar{-R}} & 0 & -\bar{R}\bar{R}\bar{f}\bar{s}^2 & \bar{R}^2\bar{f}^2\bar{s}^2 & \frac{fsc}{\bar{-f}} & 0 & -\bar{R}\bar{R}\bar{f}sc & \bar{f}fsc & -\frac{\bar{R}^2\bar{f}^2\bar{s}^2}{\bar{f}^2\bar{s}^2} & 0 & \multicolumn{3}{c|}{} \\
\hline
\end{array}
$$

$$
\left(\begin{array}{cccc|cccc|cccc|cccc}
 & & & & & & & & & & & & & & & \\
 & & & & & & & & & & & & & & & \\
 & & * & & & & & & & & & & & & & \\
 & & & & & & & & & & & & & & & \\
\hline
 & & & & 0 & \frac{\bar{\bar{R}}}{\bar{R}} & 0 & 0 & 0 & 0 & \frac{\bar{\bar{R}}}{\bar{R}} & 0 & 0 & 0 & 0 & \frac{\bar{\bar{R}}}{\bar{R}} \\
 & & & & \bar{\bar{R}}R & 0 & 0 & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} \\
 & & & & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & \bar{\bar{R}}R\bar{f}^{2} & \frac{\bar{R}ff}{\bar{R}} & 0 & 0 & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} \\
 & & & & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & 0 & 0 & \frac{\bar{R}c}{\bar{-}Rs} & \bar{\bar{R}}R\bar{f}^{2}\bar{s}^{2} & \frac{\bar{R}ff\bar{s}^{2}}{\bar{R}} & \frac{\bar{R}sc}{\bar{R}} & 0 \\
\hline
0 & \frac{\bar{\bar{R}}^{2}}{\bar{-}R^{2}} & 0 & 0 & & & & & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} \\
0 & 0 & 0 & 0 & & & & & 0 & 0 & \frac{f/f}{\bar{-}\bar{R}^{2}} & 0 & 0 & 0 & 0 & \frac{f/f}{\bar{-}\bar{R}^{2}} \\
0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & & * & & & \bar{R}Rff & \bar{-}ff & 0 & 0 & 0 & 0 & 0 & \frac{f\bar{f}}{\bar{-}f\bar{f}} \\
0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & & & & & 0 & 0 & \frac{fc}{\bar{-}fs} & \bar{R}Rf\bar{f}^{2}\bar{s}^{2} & \bar{-}f\bar{f}^{2}\bar{s}^{2} & \frac{fsc}{\bar{f}} & 0 & \frac{fc}{\bar{-}fs} \\
\hline
0 & 0 & \frac{\bar{R}^{2}}{\bar{-}R^{2}} & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & & & & & 0 & 0 & 0 & \frac{\bar{R}c}{\bar{-}Rs} \\
0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & 0 & 0 & \frac{f^{2}}{\bar{-}f^{2}} & 0 & & & & & 0 & 0 & 0 & \frac{fc}{\bar{-}fs} \\
0 & \frac{\bar{R}ff}{\bar{R}} & 0 & 0 & \bar{R}Rff & \bar{-}\bar{\bar{R}}^{2}\bar{f}^{2} & 0 & 0 & & * & & & 0 & 0 & 0 & \frac{\bar{c}^{2}}{\bar{-}\bar{s}^{2}} \\
0 & 0 & 0 & \frac{\bar{R}c}{\bar{-}Rs} & 0 & 0 & 0 & \frac{fc}{\bar{-}fs} & & & & & \bar{R}R\bar{f}^{2}sc & \bar{-}f\bar{f}sc & \bar{s}^{2} & 0 \\
\hline
0 & 0 & 0 & \frac{\bar{\bar{R}}^{2}}{\bar{-}R^{2}} & 0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & 0 & 0 & \frac{\bar{R}c}{\bar{-}Rs} & & & & \\
0 & 0 & 0 & \frac{\bar{R}f}{\bar{-}Rf} & 0 & 0 & 0 & \frac{f^{2}}{\bar{-}f^{2}} & 0 & 0 & 0 & \frac{fc}{\bar{-}fs} & & & * & \\
0 & 0 & 0 & \frac{\bar{R}c}{\bar{-}Rs} & 0 & 0 & 0 & \frac{fc}{\bar{-}fs} & 0 & 0 & 0 & \frac{\bar{c}^{2}}{\bar{-}\bar{s}^{2}} & & & & \\
0 & \frac{\bar{R}ff\bar{s}^{2}}{\bar{R}} & \frac{\bar{R}sc}{\bar{R}} & 0 & \bar{R}Rff\bar{s}^{2} & \bar{-}\bar{\bar{R}}^{2}\bar{f}^{2}\bar{s}^{2} & \frac{fsc}{\bar{f}} & 0 & \bar{R}Rf\bar{f}sc & \bar{-}f\bar{f}sc & \frac{\bar{f}^{2}\bar{s}^{2}}{\bar{\bar{R}}^{2}\bar{f}^{2}\bar{s}^{2}} & 0 & & & & \\
\end{array}\right)
$$

$$
= \bar{\mathfrak{h}}\mathfrak{x}\bar{\mathfrak{y}}^{\sharp} - \mathfrak{y}\mathfrak{x}\bar{\mathfrak{y}}^{\sharp}
$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 & \bar{\bar{R}}/R & 0 & 0 \\ \bar{\bar{R}}R & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 & 0 & \bar{\bar{R}}/R & 0 \\ 1 & 0 & 0 & 0 \\ \bar{\bar{R}}R\bar{f}^{2} & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 & 0 & 0 & \bar{\bar{R}}/R \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ \bar{\bar{R}}R\bar{f}^{2}\bar{s}^{2} & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 & -\bar{\bar{R}}/R & 0 & 0 \\ -\bar{\bar{R}}R & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & \underline{\bar{f}}/f\text{-}\bar{R}^{2} & 0 \\ 0 & \bar{R}\bar{f}^{2}\text{-}\underline{\bar{f}}f & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \underline{\bar{f}}/f\text{-}\bar{R}^{2} \\ 1 & 0 & 0 & 0 \\ 0 & \underbrace{\bar{R}^{2}f\text{-}\underline{\bar{f}}}f^{2}\bar{s}^{2} & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 & -\bar{\bar{R}}/R & 0 \\ 1 & 0 & 0 & 0 \\ -\bar{\bar{R}}R\bar{f}^{2} & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & \bar{R}\text{-}\underline{\bar{f}}/f & 0 \\ 0 & \underline{\bar{f}}f\text{-}\bar{R}^{2}\bar{f}^{2} & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & \bar{f}\text{-}1\text{-}\bar{R}^{2}\bar{f}^{2} & \\ 0 & 0 & \underbrace{\bar{R}^{2}\bar{f}^{2}\text{+}1\text{-}\bar{f}^{2}}\bar{s}^{2} & 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 & 0 & -\bar{\bar{R}}/R \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ -\bar{\bar{R}}R\bar{f}^{2}\bar{s}^{2} & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \bar{R}\text{-}\underline{\bar{f}}/f \\ 1 & 0 & 0 & 0 \\ 0 & \underbrace{\underline{\bar{f}}\text{-}\bar{R}f}f^{2}\bar{s}^{2} & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \bar{R}^{2}\bar{f}^{2}\text{+}1\text{-}\bar{f}^{2} \\ 0 & 0 & \underbrace{\bar{f}^{2}\text{-}1\text{-}\bar{R}^{2}\bar{f}^{2}}\bar{s}^{2} & 0 \end{bmatrix} \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Ricci Umordnung $\tilde{\curvearrowleft}=$

$$\begin{array}{|c|c|c|c|}
\hline
\begin{matrix} 1 & 0 & 0 & 0 \\ 0 & -\frac{\bar{\bar{R}}}{R} & 0 & 0 \\ 0 & 0 & -\frac{\bar{\bar{R}}}{R} & 0 \\ 0 & 0 & 0 & -\frac{\bar{\bar{R}}}{R} \end{matrix} &
\begin{matrix} 0 & \frac{\bar{\bar{R}}}{R} & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} &
\begin{matrix} 0 & 0 & \frac{\bar{\bar{R}}}{R} & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} &
\begin{matrix} 0 & 0 & 0 & \frac{\bar{\bar{R}}}{R} \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} \\
\hline
\begin{matrix} 1 & 0 & 0 & 0 \\ -\bar{\bar{R}}R & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} &
\begin{matrix} \bar{\bar{R}}R & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & \bar{R}\text{-}\underline{\bar{f}}/f & 0 \\ 0 & 0 & 0 & \bar{R}\text{-}\underline{\bar{f}}/f \end{matrix} &
\begin{matrix} 1 & 0 & 0 & 0 \\ 0 & 0 & \underline{\bar{f}}/f\text{-}\bar{R} & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} &
\begin{matrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \underline{\bar{f}}/f\text{-}\bar{R} \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} \\
\hline
\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ -\bar{\bar{R}}Rf^2 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} &
\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & \underline{f}f\text{-}\bar{R}\bar{f}^2 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} &
\begin{matrix} \bar{\bar{R}}Rf^2 & 0 & 0 & 0 \\ 0 & \bar{R}\bar{f}^2\text{-}\underline{f}f & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \bar{R}\bar{f}^2\text{+}1\text{-}\bar{\underline{f}}^2 \end{matrix} &
\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \bar{\underline{f}}^2\text{-}1\text{-}\bar{R}\bar{f}^2 \\ 1 & 0 & 0 & 0 \end{matrix} \\
\hline
\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ -\bar{\bar{R}}Rf^2s^2 & 0 & 0 & 0 \end{matrix} &
\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & \underbrace{\underline{f}\text{-}\bar{R}f}\,f^2s^2 & 0 & 0 \end{matrix} &
\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & \underbrace{\bar{\underline{f}}^2\text{-}1\text{-}\bar{R}\bar{f}^2}\,s^2 & 0 \end{matrix} &
\begin{matrix} \bar{\bar{R}}Rf^2s^2 & 0 & 0 & 0 \\ 0 & \underbrace{\bar{R}f\text{-}\underline{f}}\,f^2s^2 & 0 & 0 \\ 0 & 0 & \underbrace{\bar{R}\bar{f}^2\text{+}1\text{-}\bar{\underline{f}}^2}\,s^2 & 0 \\ 1 & 0 & 0 & 0 \end{matrix} \\
\hline
\end{array}$$

$$\text{Ric} \;=\; \text{tr}\;\tilde{\curvearrowleft}= \begin{array}{|c|c|c|c|}
\hline
-3\bar{\bar{R}}/R & 0 & 0 & 0 \\
\hline
0 & \bar{\bar{R}}R\text{+}2\bar{R}^2\text{-}2\underline{f}/f & 0 & 0 \\
\hline
0 & 0 & \bar{\bar{R}}Rf^2\text{+}2\bar{R}^2f^2\text{+}1\text{-}\underline{f}f\text{-}\underline{f}^2 & 0 \\
\hline
0 & 0 & 0 & \underbrace{\bar{\bar{R}}Rf^2\text{+}2\bar{R}^2f^2\text{+}1\text{-}\underline{f}f\text{-}\underline{f}^2}\,s^2 \\
\hline
\end{array}$$

$$\text{scal} \;=\; \text{tr}\;\; \text{Ric}\;\; \overset{-1.}{\curlywedge} =$$

$$\text{tr}\;\; \begin{array}{|c|c|c|c|}\hline -3\bar{\bar{R}}/R & 0 & 0 & 0 \\ \hline 0 & \bar{\bar{R}}R+2\bar{R}^2-2\underline{\underline{f}}/f & 0 & 0 \\ \hline 0 & 0 & \bar{\bar{R}}Rf^2+2\bar{R}^2f^2+1-\underline{\underline{f}}f-\underline{f}^2 & 0 \\ \hline 0 & 0 & 0 & \underbrace{\bar{\bar{R}}Rf^2+2\bar{R}^2f^2+1-\underline{\underline{f}}f-\underline{f}^2}\, s^2 \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|}\hline 1 & 0 & 0 & 0 \\ \hline 0 & -R^{-2} & 0 & 0 \\ \hline 0 & 0 & -R^{-2}f^{-2} & 0 \\ \hline 0 & 0 & 0 & -R^{-2}f^{-2}s^{-2} \\ \hline \end{array}$$

$$= -3\frac{\bar{\bar{R}}}{R}-\frac{\bar{\bar{R}}}{R}-2\frac{\bar{R}^2}{R^2}+2\frac{\underline{\underline{f}}}{R^2f}+2\frac{\underline{f}^2-1}{R^2f^2}-2\frac{\bar{\bar{R}}}{R}$$

$$-4\frac{\bar{R}^2}{R^2}+2\frac{\underline{\underline{f}}}{R^2f} = -2\frac{3\bar{\bar{R}}Rf^2+3\bar{R}^2f^2+1-\underline{f}^2-2\underline{\underline{f}}f}{R^2f^2}$$

$$\text{Ein} \;=\; \text{Ric} \;-\; \frac{\text{scal}}{2}\; \curlywedge =$$

$$\begin{array}{|c|c|c|c|}\hline -3\bar{\bar{R}}/R & 0 & 0 & 0 \\ \hline 0 & \bar{\bar{R}}R+2\bar{R}^2-2\underline{\underline{f}}/f & 0 & 0 \\ \hline 0 & 0 & \bar{\bar{R}}Rf^2+2\bar{R}^2f^2+1-\underline{\underline{f}}f-\underline{f}^2 & 0 \\ \hline 0 & 0 & 0 & \underbrace{\bar{\bar{R}}Rf^2+2\bar{R}^2f^2+1-\underline{\underline{f}}f-\underline{f}^2}\, s^2 \\ \hline \end{array}$$

$$+\frac{3\bar{\bar{R}}Rf^2+3\bar{R}^2f^2+1-\underline{f}^2-2\underline{\underline{f}}f}{R^2f^2} \begin{array}{|c|c|c|c|}\hline 1 & 0 & 0 & 0 \\ \hline 0 & -R^2 & 0 & 0 \\ \hline 0 & 0 & -R^2f^2 & 0 \\ \hline 0 & 0 & 0 & -R^2f^2s^2 \\ \hline \end{array}$$

$$= \begin{array}{|c|c|c|c|}\hline \frac{3\bar{R}^2}{R^2}+\frac{1-\underline{f}^2-2\underline{\underline{f}}f}{R^2f^2} & 0 & 0 & 0 \\ \hline 0 & -2\bar{\bar{R}}R-\bar{R}^2+\frac{\underline{f}^2-1}{f^2} & 0 & 0 \\ \hline 0 & 0 & -2\bar{\bar{R}}Rf^2-\bar{R}^2f^2+\underline{\underline{f}}f & 0 \\ \hline 0 & 0 & 0 & \underbrace{-2\bar{\bar{R}}Rf^2-\bar{R}^2f^2+\underline{\underline{f}}f}\, s^2 \\ \hline \end{array}$$

$$= 8\pi G \begin{array}{|c|c|c|c|}\hline \underline{\varrho} & 0 & 0 & 0 \\ \hline 0 & p & 0 & 0 \\ \hline 0 & 0 & p & 0 \\ \hline 0 & 0 & 0 & p \\ \hline \end{array} \begin{array}{|c|c|c|c|}\hline 1 & 0 & 0 & 0 \\ \hline 0 & -R^2 & 0 & 0 \\ \hline 0 & 0 & -R^2 f^2 & 0 \\ \hline 0 & 0 & 0 & -R^2 f^2 s^2 \\ \hline \end{array} = 8\pi G \begin{array}{|c|c|c|c|}\hline \underline{\varrho} & 0 & 0 & 0 \\ \hline 0 & -R^2 p & 0 & 0 \\ \hline 0 & 0 & -R^2 f^2 p & 0 \\ \hline 0 & 0 & 0 & -R^2 f^2 s^2 p \\ \hline \end{array} \text{ stress-energy}$$

$$\Rightarrow 8\pi G\varrho = \frac{3\bar{R}^2}{R^2} + \frac{1 - \underline{\bar{f}}^2 - 2\underline{\bar{\bar{f}}} f}{R^2 f^2}$$

$$8\pi G p = \frac{2\bar{\bar{R}}}{R} + \frac{\bar{R}^2}{R^2} + \frac{1 - \underline{\bar{f}}^2}{R^2 f^2} = \frac{2\bar{\bar{R}}}{R} + \frac{\bar{R}^2}{R^2} - \frac{\underline{\bar{\bar{f}}}}{R^2 f}$$

$$\Rightarrow 1 + \underline{\bar{\bar{f}}} f - \underline{\bar{f}}^2 = 0 \Rightarrow f_{\omega} = \begin{cases} A \sin \dfrac{\omega}{A} & \varkappa = 1 \\ \omega & \varkappa = 0 \\ A \sinh \dfrac{\omega}{A} & \varkappa = -1 \end{cases} \Rightarrow \frac{\underline{\bar{\bar{f}}}}{f} = \text{ cst } = \frac{-\varkappa}{A^2}$$

$$8\pi G\varrho = \frac{3\bar{R}^2}{R^2} - \frac{3\underline{\bar{\bar{f}}}}{R^2 f} \Rightarrow \bar{R}^2 = \frac{8\pi G}{3} R^2 \varrho - \frac{\varkappa}{A^2}$$

$$8\pi G p = \frac{2\bar{\bar{R}}}{R} + \frac{\bar{R}^2}{R^2} - \frac{\underline{\bar{\bar{f}}}}{R^2 f} = \frac{2\bar{\bar{R}}}{R} + \frac{8\pi G}{3}\varrho \Rightarrow \bar{\bar{R}} = \frac{4\pi G}{3} R \underbrace{3p - \varrho}$$