

$$\frac{dx^\varphi}{d\tau} = v^\varphi = \frac{N}{\mu} \left(P^\varphi + \frac{1}{2\mu^2 \Delta} S^{\varphi\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} \right)$$

$$\frac{dx^\varphi}{d\tau} = v^\varphi = \frac{N}{\mu} \left(P^\varphi + \frac{1}{2\mu^2 \Delta} c \right)$$

$$\frac{N}{\mu} = \frac{1}{\left(\mu^2 - \frac{1}{4\mu^4 \Delta^2} \underbrace{S^{\mu\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} S_{\mu\tau} R^{\tau\delta\lambda} P_\delta S_\lambda}_{A} \right)^{1/2}}$$

$$\frac{N}{\mu} = \frac{\mu^2}{\left(\mu^2 - \frac{A}{4\Delta^2} \right)^{1/2}}$$

$$A = S^{\mu\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} S_{\mu\tau} R^{\tau\delta\lambda} P_\delta S_\lambda$$

$$A = S^{\mu\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{\mu\nu} S^{\nu\tau} R_{\tau\delta\lambda} P_\delta S_\lambda$$

$$A = S^{t\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{tt} S^{\nu\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + S^{r\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{rr} S^{\nu\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + S^{\theta\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{\theta\theta} S^{\nu\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + S^{\varphi\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{\varphi\varphi} S^{\nu\tau} R_{\tau\delta\lambda} P_\delta S_\lambda$$

$$A = S^{t\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{tt} S^{t\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + S^{r\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{rr} S^{r\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + S^{\theta\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{\theta\theta} S^{\theta\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + S^{\varphi\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} g_{\varphi\varphi} S^{\varphi\tau} R_{\tau\delta\lambda} P_\delta S_\lambda$$

$$A = g_{tt} S^{t\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} S^{t\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + g_{rr} S^{r\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} S^{r\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + g_{\theta\theta} S^{\theta\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} S^{\theta\tau} R_{\tau\delta\lambda} P_\delta S_\lambda \\ + g_{\varphi\varphi} S^{\varphi\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} S^{\varphi\tau} R_{\tau\delta\lambda} P_\delta S_\lambda$$

$$A = g_{tt}(S^{t\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma})^2 + g_{rr}(S^{r\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma})^2 + g_{\theta\theta}(S^{\theta\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma})^2 + g_{\varphi\varphi}(S^{\varphi\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma})^2$$

$$A = g_{tt} a^2 + g_{rr} b^2 + g_{\theta\theta} c^2 + g_{\varphi\varphi} d^2$$

$$a = S^{t\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma}$$

$$a = S^{t\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} + S^{t\theta} R_{\theta\alpha\beta\gamma} P^\alpha S^{\beta\gamma} + S^{t\varphi} R_{\varphi\alpha\beta\gamma} P^\alpha S^{\beta\gamma}$$

$$a = S^{tr} R_{rtet} P^t S^{tr} + S^{tr} R_{r\theta\theta} P^\theta S^{\theta t} + S^{tr} R_{r\varphi\varphi} P^\varphi S^{\varphi t} \\ + S^{t\theta} R_{\theta rt} P^t S^{\theta t} + S^{t\theta} R_{\theta r\theta} P^\theta S^{\theta\theta} + S^{t\theta} R_{\theta r\varphi} P^\varphi S^{\theta\varphi} \\ + S^{t\varphi} R_{\varphi rt} P^t S^{\varphi t} + S^{t\varphi} R_{\varphi r\theta} P^\theta S^{\varphi\theta} + S^{t\varphi} R_{\varphi r\varphi} P^\varphi S^{\varphi\varphi}$$

$$a = -S^{tr} R_{rtet} P^t S^{tr} - S^{tr} R_{r\theta\theta} P^\theta S^{\theta t} - S^{tr} R_{r\varphi\varphi} P^\varphi S^{\varphi t} \\ - S^{t\theta} R_{\theta rt} P^t S^{\theta t} - S^{t\theta} R_{\theta r\theta} P^\theta S^{\theta\theta} - S^{t\theta} R_{\theta r\varphi} P^\varphi S^{\theta\varphi} \\ - S^{t\varphi} R_{\varphi rt} P^t S^{\varphi t} - S^{t\varphi} R_{\varphi r\theta} P^\theta S^{\varphi\theta} - S^{t\varphi} R_{\varphi r\varphi} P^\varphi S^{\varphi\varphi}$$

$$b = S^{r\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma}$$

$$b = S^{r\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma} + S^{r\theta} R_{\theta\alpha\beta\gamma} P^\alpha S^{\beta\gamma} + S^{r\varphi} R_{\varphi\alpha\beta\gamma} P^\alpha S^{\beta\gamma}$$

$$b = S^{r\sigma} R_{\sigma rtr} P^r S^{tr} + S^{r\sigma} R_{\sigma r\theta\theta} P^\theta S^{\theta t} + S^{r\sigma} R_{\sigma r\varphi\varphi} P^\varphi S^{\varphi t} \\ + S^{r\theta} R_{\theta rr} P^r S^{\theta t} + S^{r\theta} R_{\theta r\theta} P^\theta S^{\theta\theta} + S^{r\theta} R_{\theta r\varphi} P^\varphi S^{\theta\varphi} \\ + S^{r\varphi} R_{\varphi rr} P^r S^{\varphi t} + S^{r\varphi} R_{\varphi r\theta} P^\theta S^{\varphi\theta} + S^{r\varphi} R_{\varphi r\varphi} P^\varphi S^{\varphi\varphi}$$

$$b = -S^{r\sigma} R_{\sigma rtr} P^r S^{tr} - S^{r\sigma} R_{\sigma r\theta\theta} P^\theta S^{\theta t} - S^{r\sigma} R_{\sigma r\varphi\varphi} P^\varphi S^{\varphi t} \\ - S^{r\theta} R_{\theta rr} P^r S^{\theta t} - S^{r\theta} R_{\theta r\theta} P^\theta S^{\theta\theta} - S^{r\theta} R_{\theta r\varphi} P^\varphi S^{\theta\varphi} \\ - S^{r\varphi} R_{\varphi rr} P^r S^{\varphi t} - S^{r\varphi} R_{\varphi r\theta} P^\theta S^{\varphi\theta} - S^{r\varphi} R_{\varphi r\varphi} P^\varphi S^{\varphi\varphi}$$

$$c = S^{\theta\sigma} R_{\sigma\alpha\beta\gamma} P^\alpha S^{\beta\gamma}$$

$$c = S^{\theta t} R_{t\alpha\beta\gamma} P^\alpha S^{\beta\gamma} + S^{\theta r} R_{r\alpha\beta\gamma} P^\alpha S^{\beta\gamma} + S^{\theta\varphi} R_{\varphi\alpha\beta\gamma} P^\alpha S^{\beta\gamma}$$

$$c = S^{\theta t} R_{t rtr} P^r S^{tr} + S^{\theta t} R_{t r\theta\theta} P^\theta S^{\theta t} + S^{\theta t} R_{t r\varphi\varphi} P^\varphi S^{\varphi t} \\ + S^{\theta r} R_{r rt} P^r S^{tr} + S^{\theta r} R_{r r\theta\theta} P^\theta S^{\theta t} + S^{\theta r} R_{r r\varphi\varphi} P^\varphi S^{\varphi t} \\ + S^{\theta\varphi} R_{\varphi rt} P^r S^{tr} + S^{\theta\varphi} R_{\varphi r\theta\theta} P^\theta S^{\theta t} + S^{\theta\varphi} R_{\varphi r\varphi\varphi} P^\varphi S^{\varphi t}$$

$$c = -S^{\theta t} R_{t rtr} P^r S^{tr} - S^{\theta t} R_{t r\theta\theta} P^\theta S^{\theta t} - S^{\theta t} R_{t r\varphi\varphi} P^\varphi S^{\varphi t} \\ + S^{\theta r} R_{r rt} P^r S^{tr} - S^{\theta r} R_{r r\theta\theta} P^\theta S^{\theta t} - S^{\theta r} R_{r r\varphi\varphi} P^\varphi S^{\varphi t} \\ - S^{\theta\varphi} R_{\varphi rt} P^r S^{tr} - S^{\theta\varphi} R_{\varphi r\theta\theta} P^\theta S^{\theta t} - S^{\theta\varphi} R_{\varphi r\varphi\varphi} P^\varphi S^{\varphi t}$$

$$d = S^{\mu\sigma} R_{\alpha\sigma\beta\gamma} P^\alpha S^{\beta\gamma}$$

$$d = S^{\mu t} R_{t\alpha\beta\gamma} P^\alpha S^{\beta\gamma} + S^{\mu r} R_{r\alpha\beta\gamma} P^\alpha S^{\beta\gamma} + S^{\mu\theta} R_{\theta\alpha\beta\gamma} P^\alpha S^{\beta\gamma}$$

$$\begin{aligned} d = & S^{\mu t} R_{trt\gamma} P^\gamma S^{tr} + S^{\mu t} R_{tate} P^\theta S^{t\theta} + S^{\mu t} R_{t\psi t\psi} P^\psi S^{t\psi} \\ & + S^{\mu r} R_{rtet} P^\theta S^{rt} + S^{\mu r} R_{rare} P^\theta S^{re} + S^{\mu r} R_{r\psi r\psi} P^\psi S^{r\psi} \\ & + S^{\mu\theta} R_{\theta tet} P^\theta S^{\theta t} + S^{\mu\theta} R_{\theta are} P^\theta S^{\theta e} + S^{\mu\theta} R_{\theta\psi\theta\psi} P^\psi S^{\theta\psi} \end{aligned}$$

$$\begin{aligned} d = & -S^{t\psi} R_{trt\gamma} P^\gamma S^{tr} - S^{t\psi} R_{tate} P^\theta S^{t\theta} - S^{t\psi} R_{t\psi t\psi} P^\psi S^{t\psi} \\ & + S^{r\psi} R_{rtet} P^\theta S^{rt} - S^{r\psi} R_{rare} P^\theta S^{re} - S^{r\psi} R_{r\psi r\psi} P^\psi S^{r\psi} \\ & + S^{\theta\psi} R_{\theta tet} P^\theta S^{\theta t} - S^{\theta\psi} R_{\theta are} P^\theta S^{\theta e} - S^{\theta\psi} R_{\theta\psi\theta\psi} P^\psi S^{\theta\psi} \end{aligned}$$

$$\Delta = 1 + \frac{1}{4\mu^2} R_{\alpha\sigma\beta\gamma} S^{\alpha\sigma} S^{\beta\gamma}$$

$$\begin{aligned} \Delta = & 1 + \frac{1}{4\mu^2} (R_{t\sigma\beta\gamma} S^{t\sigma} S^{\beta\gamma} + R_{r\sigma\beta\gamma} S^{r\sigma} S^{\beta\gamma} \\ & + R_{\theta\sigma\beta\gamma} S^{\theta\sigma} S^{\beta\gamma} + R_{\psi\sigma\beta\gamma} S^{\psi\sigma} S^{\beta\gamma}) \end{aligned}$$

$$\begin{aligned} \Delta = & 1 + \frac{1}{4\mu^2} (R_{tr\beta\gamma} S^{tr} S^{\beta\gamma} + R_{te\beta\gamma} S^{t\theta} S^{\beta\gamma} + R_{t\psi\beta\gamma} S^{t\psi} S^{\beta\gamma} \\ & + R_{rt\beta\gamma} S^{rt} S^{\beta\gamma} + R_{ra\beta\gamma} S^{r\theta} S^{\beta\gamma} + R_{r\psi\beta\gamma} S^{r\psi} S^{\beta\gamma} \\ & + R_{\theta t\beta\gamma} S^{\theta t} S^{\beta\gamma} + R_{\theta e\beta\gamma} S^{\theta\theta} S^{\beta\gamma} + R_{\theta\psi\beta\gamma} S^{\theta\psi} S^{\beta\gamma} \\ & + R_{\psi t\beta\gamma} S^{\psi t} S^{\beta\gamma} + R_{\psi r\beta\gamma} S^{\psi r} S^{\beta\gamma} + R_{\psi\theta\beta\gamma} S^{\psi\theta} S^{\beta\gamma}) \end{aligned}$$

$$\begin{aligned} \Delta = & 1 + \frac{1}{2\mu^2} (R_{tr\beta\gamma} S^{tr} S^{\beta\gamma} + R_{te\beta\gamma} S^{t\theta} S^{\beta\gamma} + R_{t\psi\beta\gamma} S^{t\psi} S^{\beta\gamma} \\ & + R_{ra\beta\gamma} S^{r\theta} S^{\beta\gamma} + R_{r\psi\beta\gamma} S^{r\psi} S^{\beta\gamma} + R_{\theta\psi\beta\gamma} S^{\theta\psi} S^{\beta\gamma}) \end{aligned}$$

$$\begin{aligned} \Delta = & 1 + \frac{1}{\mu^2} (R_{trtr} S^{tr} S^{tr} + R_{tate} S^{t\theta} S^{t\theta} + R_{t\psi t\psi} S^{t\psi} S^{t\psi} \\ & + R_{rare} S^{r\theta} S^{r\theta} + R_{r\psi r\psi} S^{r\psi} S^{r\psi} + R_{\theta\psi\theta\psi} S^{\theta\psi} S^{\theta\psi}) \end{aligned}$$