APPENDIX

The pseudo spheroidal space-time metric derived in Chapter-2 has the form

$$ds^2 = e^{\nu(r)}dt^2 - \frac{1+K\dfrac{r^2}{R^2}}{1+\dfrac{r^2}{R^2}}dr^2 - r^2 d\theta^2 - r^2\sin^2\theta\, d\phi^2. \qquad \text{(A.1)}$$

The non-zero componerts of Ricci tensor and Ricci scalar for the metric (A.1) are given below.

$$R_{00} = -\frac{e^{\nu}\left(1+\dfrac{r^2}{R^2}\right)}{\left(1+K\dfrac{r^2}{R^2}\right)}\left[\frac{\nu''}{2}+\frac{\nu'^2}{4}+\frac{\nu'}{r}-\frac{(K-1)r\nu'}{2R^2\left(1+\dfrac{r^2}{R^2}\right)\left(1+K\dfrac{r^2}{R^2}\right)}\right]$$

$$R_{11} = \frac{\nu''}{2}+\frac{\nu'^2}{4}-\frac{(K-1)r\nu'}{2R^2\left(1+\dfrac{r^2}{R^2}\right)\left(1+K\dfrac{r^2}{R^2}\right)}-\frac{2(K-1)}{R^2\left(1+\dfrac{r^2}{R^2}\right)\left(1+K\dfrac{r^2}{R^2}\right)}$$

$$R_{22} = -\frac{\dfrac{r^2}{R^2}}{1+K\dfrac{r^2}{R^2}}\left[\frac{(K-1)}{1+K\dfrac{r^2}{R^2}}+(K-1)\right]-\frac{r\nu'}{2}\left(1+\frac{r^2}{R^2}\right)\left(1+K\frac{r^2}{R^2}\right)^{-1}$$

$$R_{33} = \sin^2\theta\, R_{22}.$$

$$R = -\frac{1+\dfrac{r^2}{R^2}}{1+K\dfrac{r^2}{R^2}}\left[\nu''+\frac{\nu'^2}{2}-\frac{[K-1]r\nu'}{R^2\left(1+\dfrac{r^2}{R^2}\right)\left(1+K\dfrac{r^2}{R^2}\right)}\right]+\frac{4(K-1)}{R^2\left(1+K\dfrac{r^2}{R^2}\right)^2}+\frac{2(K-1)}{R^2\left(1+K\dfrac{r^2}{R^2}\right)}-\frac{2\nu'}{r}\frac{\left(1+\dfrac{r^2}{R^2}\right)}{\left(1+K\dfrac{r^2}{R^2}\right)}$$

The surviving components of Einstein's tensor

$G_i^j = R_i^j - \frac{1}{2}R\delta_i^j$ are given below.

$$G_0^0 = \frac{-3(K-1)\left(1+\frac{K}{3}\frac{r^2}{R^2}\right)}{R^2\left(1+K\frac{r^2}{R^2}\right)^2}$$

$$G_1^1 = \frac{\left(1+\frac{r^2}{R^2}\right)\frac{\nu'}{r} - \frac{(K-1)}{R^2}}{\left(1+K\frac{r^2}{R^2}\right)}$$

$$G_2^2 = \frac{1+\frac{r^2}{R^2}}{1+K\frac{r^2}{R^2}}\left[\frac{\nu''}{2}+\frac{\nu'^2}{4}+\frac{\nu'}{2r}\right] - \frac{r(K-1)}{R^2}\frac{\left(\frac{\nu'}{2}+\frac{1}{r}\right)}{\left(1+K\frac{r^2}{R^2}\right)^2}.$$

$$G_3^3 = G_2^2.$$

The following are the components of the Weyl tensor.

$$C_{1212} = \frac{r^2}{12}\left[\nu'' + \frac{\nu'^2}{2} - \frac{(K-1)r\nu'}{R^2\left(1+\frac{r^2}{R^2}\right)\left(1+K\frac{r^2}{R^2}\right)} - \frac{\nu'}{r}\right] - \frac{1}{6}\frac{K(K-1)\left(\frac{r^2}{R^2}\right)^2}{\left(1+\frac{r^2}{R^2}\right)\left(1+K\frac{r^2}{R^2}\right)}.$$

$$= \frac{C_{1313}}{\sin^2\theta}$$

$$= \frac{r^2 e^{-\nu}}{2} C_{1010}$$

$$= -\frac{1+K\dfrac{r^2}{R^2}}{2r^2\left(1+\dfrac{r^2}{R^2}\right)\sin^2\theta} C_{2323}$$

$$= -\frac{1+K\dfrac{r^2}{R^2}}{1+\dfrac{r^2}{R^2}} e^{-\nu} C_{2020}$$

$$= -\frac{1+K\dfrac{r^2}{R^2}}{\left(1+\dfrac{r^2}{R^2}\right)\sin^2\theta} e^{-\nu} \ C_{3030}$$