equation)

$$\Theta(\theta) = y^{\rho}(1-y)^{\upsilon}\,{}_2F_1(-k,b;d;y)\ \ ;\ \ y = \cos^2(\theta/2)\,, \tag{38}$$

where

$$\upsilon = \rho = \frac{1}{2}\sqrt{m^2+E+M}\ ;\ b = k+4\upsilon+1;\ d = 1+2\upsilon, \tag{39}$$

$k = 0, 1, 2, \cdots$ is a "new" quantum number, and

$$\Lambda = \frac{1}{4}(b+k)^2 - \frac{1}{4} = \frac{1}{4}\left[(b+k+1)(b+k-1)\right]. \tag{40}$$

On the other hand, $V(\theta) = 1/\left(2\cos^2\theta\right)$ would (taking $\alpha = \beta = 0$ and $\gamma = 1$ in equation (13) of ref.[12) for Dirac equation) result in

$$\rho = \frac{1}{4} + \frac{1}{4}\sqrt{1+4(E+M)};\ \upsilon = \frac{1}{2}\sqrt{m^2+E+M} \tag{41}$$

$$b = k+2(\rho+\upsilon)+\frac{1}{2};\ d = 2\rho+\frac{1}{2} \tag{42}$$

and

$$\Lambda = (b+k)^2 - \frac{1}{4} = \left[\left(b+k+\frac{1}{2}\right)\left(b+k-\frac{1}{2}\right)\right] \tag{43}$$

For Schrödinger case, nevertheless, one may just replace the term $(E+M)$ by $(1/2)$ in the above expressions and get the corresponding eigenvalue results. Then the general solution for both cases would read

$$\begin{aligned}\chi_1(r,\theta,\varphi) &= \psi_{Sch}(r,\theta,\varphi)\\ &= N_{n_r,k,m}R_{n_r,k}(r)\,y^{\rho}(1-y)^{\upsilon}\,{}_2F_1(-k,b;d;y)\,I_{2m}\left(2ae^{i\varphi/2}\right),\end{aligned} \tag{44}$$

where $N_{n_r,k,m}$ is the normalization constant that can be obtained in a straightforward textbook procedure. Hereby, we witness that the general solution (44)