introduced some ambiguity through our choice of $A(z)$ and $\Phi(z)$). Requiring that the solution is simply normalizable gives us a discrete spectrum:

$$v_n(z) = z^2 \sqrt{\frac{2}{n+1}} L_n^1(z^2) \tag{5.30}$$

where L_n^m are the associated Laguerre polynomials. The masses and decay constants are found using the same formulae in section 5.3.1, the only difference being the presence of the non-zero dilaton, which changes the results to:

$$\begin{aligned} m_n^2 &= 4(n+1) && (5.31) \\ F_{\rho_n}^2 &= \frac{8(n+1)}{g_5^2} && (5.32) \end{aligned}$$

Note that the mass spectrum goes like $m_n^2 \sim n$, as we set out to achieve.

5.5.2 Axial Vector Mesons

The treatment of the axial vector mesons follows that of section 5.3.2. We define the axial gauge field as $A \equiv \frac{1}{2}(A_L - A_R)$, and the equation of motion is found to be

$$\partial_z \left(\frac{e^{-z^2}}{z} \partial_z a_n \right) + \left(m_n^2 - \frac{g_5^2}{z^2} X(z)^2 \right) \frac{e^{-z^2}}{z} a_n = 0 \tag{5.33}$$

with the linearized equation of motion for the Higgs-like field $X(z)$ given by

$$\partial_z \left(\frac{e^{-z^2}}{z^3} \partial_z X(z) \right) + 3 \frac{e^{-z^2}}{z^5} X(z) = 0 \tag{5.34}$$