

$$H = \lim_{\epsilon \rightarrow 0} \left[-\mu_R \frac{\partial}{\partial \mu_R} \log(\mathcal{Z}) \right] = 12 \times \begin{pmatrix} 2a^2 & -a\,g \\ -2\,\frac{a^2}{g} & a-6\,a^2 \end{pmatrix}$$