In[37]:= $\left(\chi = \left\{\left(\text{Cos}[\lambda\,t\,/\,2] + I\,\dfrac{(\omega + \omega1\,\text{Cos}[\alpha])}{\lambda}\,\text{Sin}[\lambda\,t\,/\,2]\right)\,E^{-I\,\omega\,t/2},\right.\right.$

$\qquad\left.\left.\left(I\,\omega1\,\dfrac{\text{Sin}[\alpha]}{\lambda}\,\text{Sin}[\lambda\,t\,/\,2]\right)\,E^{I\,\omega\,t/2}\right\}\right)$ // **MatrixForm**

Out[37]//MatrixForm=

$$\left(\begin{array}{c} e^{-\frac{1}{2}\,i\,t\,\omega}\left(\text{Cos}\left[\dfrac{t\,\lambda}{2}\right] + \dfrac{i\,(\omega+\omega1\,\text{Cos}[\alpha])\,\text{Sin}\left[\frac{t\,\lambda}{2}\right]}{\lambda}\right) \\[2ex] \dfrac{i\,e^{\frac{i\,t\,\omega}{2}}\,\omega1\,\text{Sin}[\alpha]\,\text{Sin}\left[\frac{t\,\lambda}{2}\right]}{\lambda} \end{array}\right)$$

In[51]:= $\left(\mathbf{H} = \mathbf{e}\,\mathbf{h}\,\dfrac{\mathbf{B}}{\mathbf{2}\,\mathbf{m}}\,\left\{\left\{\text{Cos}[\alpha],\;\text{Sin}[\alpha]\,E^{-I\,\omega\,t}\right\},\;\left\{\text{Sin}[\alpha]\,E^{I\,\omega\,t},\;-\text{Cos}[\alpha]\right\}\right\}\right)$ // **MatrixForm**

Out[51]//MatrixForm=

$$\left(\begin{array}{cc} \dfrac{B\,e\,h\,\text{Cos}[\alpha]}{2\,m} & \dfrac{B\,e\,e^{-i\,t\,\omega}\,h\,\text{Sin}[\alpha]}{2\,m} \\[2ex] \dfrac{B\,e\,e^{i\,t\,\omega}\,h\,\text{Sin}[\alpha]}{2\,m} & -\dfrac{B\,e\,h\,\text{Cos}[\alpha]}{2\,m} \end{array}\right)$$

In[52]:= **Simplify**$\left[(I\,h\,D[\chi,\,t])\;/\!/.\;\left\{\lambda \to \text{Sqrt}\left[\omega^2 + \omega1^2 + 2\,\omega\,\omega1\,\text{Cos}[\alpha]\right],\,\omega1 \to -e\,\dfrac{B}{m}\right\}\right]$ // **MatrixForm**

**Simplify**$\left[(H.\chi)\;/\!/.\;\left\{\lambda \to \text{Sqrt}\left[\omega^2 + \omega1^2 + 2\,\omega\,\omega1\,\text{Cos}[\alpha]\right],\,\omega1 \to e\,\dfrac{B}{m}\right\}\right]$ // **MatrixForm**

**Simplify**$\left[(I\,h\,D[\chi,\,t] - H.\chi)\;/\!/.\;\left\{\lambda \to \text{Sqrt}\left[\omega^2 + \omega1^2 + 2\,\omega\,\omega1\,\text{Cos}[\alpha]\right],\,\omega1 \to -e\,\dfrac{B}{m}\right\}\right]$ //

   **MatrixForm**

Out[52]//MatrixForm=

$$\left(\begin{array}{c} \dfrac{B\,e\,e^{-\frac{1}{2}\,i\,t\,\omega}\,h\left(-i\,B\,e\,\text{Sin}\left[\frac{1}{2}\,t\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2-\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\right] + \text{Cos}[\alpha]\left(m\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2-\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\;\text{Cos}\left[\frac{1}{2}\,t\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2-\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\right] + i\,m\,\omega\,\text{Sin}\left[\frac{1}{2}\,t\,\sqrt{\ldots}\right.\right.\right.}{2\,m^2\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2-\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}} \\[4ex] \dfrac{B\,e\,e^{\frac{i\,t\,\omega}{2}}\,h\,\text{Sin}[\alpha]\left(\text{Cos}\left[\frac{1}{2}\,t\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2-\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\right] + \dfrac{i\,\omega\,\text{Sin}\left[\frac{1}{2}\,t\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2-\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\right]}{\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2-\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}}\right)}{2\,m} \end{array}\right)$$

Out[53]//MatrixForm=

$$\left(\begin{array}{c} \dfrac{B\,e\,e^{-\frac{1}{2}\,i\,t\,\omega}\,h\left(i\,B\,e\,\text{Sin}\left[\frac{1}{2}\,t\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2+\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\right] + \text{Cos}[\alpha]\left(m\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2+\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\;\text{Cos}\left[\frac{1}{2}\,t\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2+\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\right] + i\,m\,\omega\,\text{Sin}\left[\frac{1}{2}\,t\,\sqrt{\ldots}\right.\right.\right.}{2\,m^2\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2+\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}} \\[4ex] \dfrac{B\,e\,e^{\frac{i\,t\,\omega}{2}}\,h\,\text{Sin}[\alpha]\left(\text{Cos}\left[\frac{1}{2}\,t\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2+\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\right] + \dfrac{i\,\omega\,\text{Sin}\left[\frac{1}{2}\,t\,\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2+\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}\right]}{\sqrt{\frac{B^2\,e^2}{m^2}+\omega^2+\frac{2\,B\,e\,\omega\,\text{Cos}[\alpha]}{m}}}\right)}{2\,m} \end{array}\right)$$

Out[54]//MatrixForm=

$$\left(\begin{array}{c} 0 \\ 0 \end{array}\right)$$

In[55]:= $\texttt{Series}\Big[\chi \ /. \ \Big\{\texttt{Cos}[\alpha] \to \texttt{Sqrt}\big[1 - \sin\alpha^2\big], \ \texttt{Sin}[\alpha] \to \sin\alpha,$

$\omega1 \to -\texttt{e}\,\dfrac{\texttt{B}}{\texttt{m}}, \ \lambda \to \texttt{Sqrt}\big[\omega^2 + \omega1^2 + 2\,\omega\,\omega1\,\texttt{Sqrt}\big[1 - \sin\alpha^2\big]\big]\Big\}, \ \{\sin\alpha, \ 0, \ 2\}\Big]$

Out[55]= $\left\{ e^{-\frac{1}{2} \, \text{i} \, \texttt{t} \, \omega} \left( \texttt{Cos}\left[\frac{1}{2} \, \texttt{t} \, \sqrt{(\omega + \omega1)^2}\,\right] + \dfrac{\text{i} \, (-\texttt{B}\,\texttt{e} + \texttt{m}\,\omega) \, \texttt{Sin}\left[\frac{1}{2}\,\texttt{t}\,\sqrt{(\omega+\omega1)^2}\,\right]}{\texttt{m}\,\sqrt{(\omega+\omega1)^2}} \right) + \right.$

$e^{-\frac{1}{2}\,\text{i}\,\texttt{t}\,\omega}\left( \dfrac{\texttt{t}\,\omega\,\omega1\,\texttt{Sin}\left[\frac{1}{2}\,\texttt{t}\,\sqrt{(\omega+\omega1)^2}\,\right]}{4\,\sqrt{(\omega+\omega1)^2}} + \text{i}\left( -\dfrac{\texttt{t}\,\omega\,\left(-\frac{\texttt{B}\,\texttt{e}}{\texttt{m}}+\omega\right)\,\omega1\,\texttt{Cos}\left[\frac{1}{2}\,\texttt{t}\,\sqrt{(\omega+\omega1)^2}\,\right]}{4\,\sqrt{(\omega+\omega1)^2}\,\sqrt{\omega^2+2\,\omega\,\omega1+\omega1^2}} + \right.\right.$

$\left.\left.\left. \left( \dfrac{\omega\,\left(-\frac{\texttt{B}\,\texttt{e}}{\texttt{m}}+\omega\right)\,\omega1}{2\,\left((\omega+\omega1)^2\right)^{3/2}} + \dfrac{\texttt{B}\,\texttt{e}}{2\,\texttt{m}\,\sqrt{\omega^2+2\,\omega\,\omega1+\omega1^2}} \right)\,\texttt{Sin}\left[\frac{1}{2}\,\texttt{t}\,\sqrt{(\omega+\omega1)^2}\,\right]\right)\right)\right)\sin\alpha^2 +$

$\texttt{O}[\sin\alpha]^3, \ -\dfrac{\text{i}\,\texttt{B}\,\texttt{e}\,e^{\frac{\text{i}\,\texttt{t}\,\omega}{2}}\,\texttt{Sin}\left[\frac{1}{2}\,\texttt{t}\,\sqrt{(\omega+\omega1)^2}\,\right]\,\sin\alpha}{\texttt{m}\,\sqrt{(\omega+\omega1)^2}} + \texttt{O}[\sin\alpha]^3 \right\}$