$$
H_{DD,ee} = \begin{bmatrix}
\frac{D_1}{3} & 0 & 0 & D_2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{2D_1}{3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
D_2 & 0 & 0 & \frac{D_1}{3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{D_1}{3} & 0 & 0 & D_2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{2D_1}{3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & D_2 & 0 & 0 & \frac{D_1}{3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{D_1}{3} & 0 & 0 & D_2 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2D_1}{3} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & D_2 & 0 & 0 & \frac{D_1}{3} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{D_1}{3} & 0 & 0 & D_2 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2D_1}{3} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & D_2 & 0 & 0 & \frac{D_1}{3}
\end{bmatrix}
$$

$$
\begin{aligned}
&|1,1\rangle \otimes \left|+\tfrac{1}{2},+\tfrac{1}{2}\right\rangle \\
&|1,0\rangle \otimes \left|+\tfrac{1}{2},+\tfrac{1}{2}\right\rangle \\
&|0,0\rangle \otimes \left|+\tfrac{1}{2},+\tfrac{1}{2}\right\rangle \\
&|1,-1\rangle \otimes \left|+\tfrac{1}{2},+\tfrac{1}{2}\right\rangle \\
&|1,1\rangle \otimes \left|+\tfrac{1}{2},-\tfrac{1}{2}\right\rangle \\
&|1,0\rangle \otimes \left|+\tfrac{1}{2},-\tfrac{1}{2}\right\rangle \\
&|0,0\rangle \otimes \left|+\tfrac{1}{2},-\tfrac{1}{2}\right\rangle \\
&|1,-1\rangle \otimes \left|+\tfrac{1}{2},-\tfrac{1}{2}\right\rangle \\
&|1,1\rangle \otimes \left|-\tfrac{1}{2},+\tfrac{1}{2}\right\rangle \\
&|1,0\rangle \otimes \left|-\tfrac{1}{2},+\tfrac{1}{2}\right\rangle \\
&|0,0\rangle \otimes \left|-\tfrac{1}{2},+\tfrac{1}{2}\right\rangle \\
&|1,-1\rangle \otimes \left|-\tfrac{1}{2},+\tfrac{1}{2}\right\rangle \\
&|1,1\rangle \otimes \left|-\tfrac{1}{2},-\tfrac{1}{2}\right\rangle \\
&|1,0\rangle \otimes \left|-\tfrac{1}{2},-\tfrac{1}{2}\right\rangle \\
&|0,0\rangle \otimes \left|-\tfrac{1}{2},-\tfrac{1}{2}\right\rangle \\
&|1,-1\rangle \otimes \left|-\tfrac{1}{2},-\tfrac{1}{2}\right\rangle
\end{aligned}
$$