$$\hbar\begin{array}{l}(3/2,3/2)\\(3/2,1/2)\\(1/2,1/2)\\(3/2,-1/2)\\(1/2,-1/2)\\(3/2,-3/2)\end{array}\left(\begin{array}{cccccc}\zeta/2-2\omega_0 & & & & & \\ & \zeta/2-\dfrac{2}{3}\omega_0 & \dfrac{2^{1/2}}{3}\omega_0 & & & \\ & \text{sym} & -\zeta-\dfrac{1}{3}\omega_0 & & & \\ & & & \zeta/2+\dfrac{2}{3}\omega_0 & \dfrac{-2^{1/2}}{3}\omega_0 & \\ & & & \text{sym} & -\zeta+\dfrac{1}{3}\omega_0 & \\ & & & & & \zeta/2+2\omega_0\end{array}\right)$$

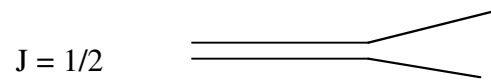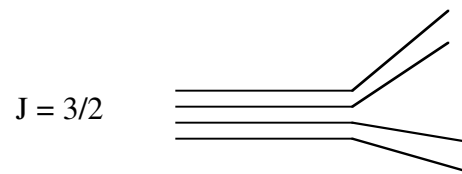$$\gamma B_z \equiv \omega_0$$

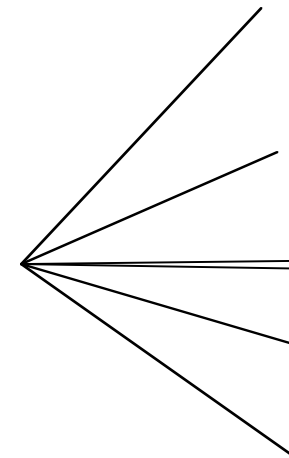(M_L,M_S) UNCOUPLED REPRESENTATION

$$\hbar\begin{array}{l}(1,1/2)\\(1,-1/2)\\(0,1/2)\\(0,-1/2)\\(-1,1/2)\\(-1,-1/2)\end{array}\overset{\begin{array}{cccccc}(1,1/2) & (1,-1/2) & (0,1/2) & (0,-1/2) & (-1,1/2) & (-1,-1/2)\end{array}}{\left(\begin{array}{cccccc}\zeta/2-2\omega_0 & & & & & \\ & -\zeta/2 & 2^{-1/2}\zeta & & & \\ & \text{sym} & -\omega_0 & & & \\ & & & \omega_0 & 2^{-1/2}\zeta & \\ & & & \text{sym} & -\zeta/2 & \\ & & & & & \zeta/2+2\omega_0\end{array}\right)}$$

(3/2,3/2)	$\zeta/2-2\omega_0$	-2γ	(1,1/2)	$\zeta/2-2\omega_0$	-2γ
(3/2,1/2)	$\zeta/2-\dfrac{2}{3}\omega_0+\dfrac{4}{27}\dfrac{\omega_0^2}{\zeta}$	$-\dfrac{2}{3}\gamma+\dfrac{8}{27}\dfrac{\gamma^2 B_z}{\zeta}$	(1,–1/2)	$-\zeta/2+\dfrac{2\zeta^2}{\omega_0}$	$-\dfrac{2\zeta^2}{\gamma B_z^2}$
(1/2,1/2)	$-\zeta-\dfrac{1}{3}\omega_0-\dfrac{4}{27}\dfrac{\omega_0^2}{\zeta}$	$-\dfrac{1}{3}\gamma-\dfrac{8}{27}\dfrac{\gamma^2 B_z}{\zeta}$	(0,1/2)	$-\omega_0-\dfrac{2\zeta^2}{\omega_0}$	$-\gamma+\dfrac{2\zeta^2}{\gamma B_z^2}$
(3/2,–1/2)	$\zeta/2+\dfrac{2}{3}\omega_0+\dfrac{4}{27}\dfrac{\omega_0^2}{\zeta}$	$+\dfrac{2}{3}\gamma+\dfrac{8}{27}\dfrac{\gamma^2 B_z}{\zeta}$	(0,–1/2)	$+\omega_0+\dfrac{2\zeta^2}{\omega_0}$	$+\gamma-\dfrac{2\zeta^2}{\gamma B_z^2}$
(1/2,–1/2)	$-\zeta+\dfrac{1}{3}\omega_0-\dfrac{4}{27}\dfrac{\omega_0^2}{\zeta}$	$+\dfrac{1}{3}\gamma-\dfrac{8}{27}\dfrac{\gamma^2 B_z}{\zeta}$	(–1,1/2)	$-\zeta/2-\dfrac{2\zeta^2}{\omega_0}$	$+\dfrac{2\zeta^2}{\gamma B_z^2}$
(3/2,–3/2)	$\zeta/2+2\omega_0$	$+2\gamma$	(–1,–1/2)	$\zeta/2+2\omega_0$	$+2\gamma$

J = 3/2

J = 1/2

$B_z \rightarrow$

$B_z \rightarrow$

Note that every eigenstate has a different Zeeman tuning rate. The gross energy level pattern and the Zeeman tuning rates tell which limiting case one is near and which state is which. The details of the nonlinear Zeeman tuning of one *assigned* level determine ζ and γ.