

## M00Q.2—Hyperfine Structure

### Problem

The hyperfine energy structure of a hydrogen atom in the  $1s$  level in a constant magnetic field  $\vec{B}$  may be represented by the Hamiltonian

$$H = 4\alpha\vec{s}_p \cdot \vec{s}_e + 2\beta\vec{s}_p \cdot \vec{B} + 2\gamma\vec{s}_e \cdot \vec{B}$$

where  $\alpha$ ,  $\beta$ , and  $\gamma$  are constants and the spin observables are  $\vec{s}_p$  and  $\vec{s}_e$ .

Find the energy eigenvalues.