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syms x y z D g
H = D*([1 0; 0 -1]^2 -2/3*[1 0; 0 1]) + g*(x*[0 1;1 0]+y*[0 -1i;1i 0]+z*[1 0;0 -1])
```

$$H = \begin{pmatrix} \frac{D}{3} + g z & g (x - y i) \\ g (x + y i) & \frac{D}{3} - g z \end{pmatrix}$$

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e = eig(H)
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$$e = \begin{pmatrix} \frac{D}{3} + g \sqrt{x^2 + y^2 + z^2} \\ \frac{D}{3} - g \sqrt{x^2 + y^2 + z^2} \end{pmatrix}$$

```
syms r t p
subs(H,x,r*sin(t)*cos(p))
```

$$\text{ans} = \begin{pmatrix} \frac{D}{3} + g z & -g (-r \cos(p) \sin(t) + y i) \\ g (r \cos(p) \sin(t) + y i) & \frac{D}{3} - g z \end{pmatrix}$$

```
subs(H,y,r*sin(t)*sin(p))
```

$$\text{ans} = \begin{pmatrix} \frac{D}{3} + g z & g (x - r \sin(p) \sin(t) i) \\ g (x + r \sin(p) \sin(t) i) & \frac{D}{3} - g z \end{pmatrix}$$

```
subs(H,z,r*cos(t))
```

$$\text{ans} = \begin{pmatrix} \frac{D}{3} + g r \cos(t) & g (x - y i) \\ g (x + y i) & \frac{D}{3} - g r \cos(t) \end{pmatrix}$$

```
a = subs(H,[x y z],[r*sin(t)*cos(p) r*sin(t)*sin(p) r*cos(t)])
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$$a = \begin{pmatrix} \frac{D}{3} + g r \cos(t) & g (r \cos(p) \sin(t) - r \sin(p) \sin(t) i) \\ g (r \cos(p) \sin(t) + r \sin(p) \sin(t) i) & \frac{D}{3} - g r \cos(t) \end{pmatrix}$$

$$\mathbf{b} = \text{eig}(\mathbf{a})$$

$$\mathbf{b} =$$

$$\begin{pmatrix} \frac{D}{3} + \sigma_1 \\ \frac{D}{3} - \sigma_1 \end{pmatrix}$$

where

$$\sigma_1 = g r \sqrt{\cos(p)^2 \sin(t)^2 + \cos(t)^2 + \sin(p)^2 \sin(t)^2}$$