

## Bloch-equations without damping:

**Hamiltonian:** 
$$H = H_{at} + V_{dip}$$
$$= \frac{\hbar\omega_0}{2}\hat{\sigma}_z - d_{eg}E_0 \cos\omega t \hat{\sigma}_x$$

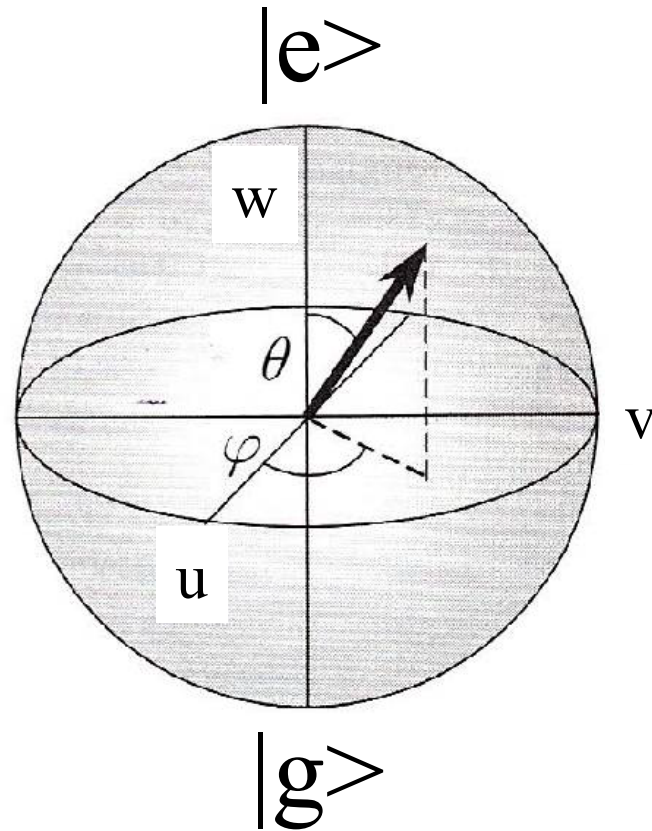
**Bloch-equations:**

$$\begin{aligned}\dot{u} &= \delta \cdot v \\ \dot{v} &= -\delta \cdot u + \Omega_R \cdot w \\ \dot{w} &= -\Omega_R \cdot v\end{aligned}$$

which can also be written as :  $\dot{\vec{R}} = \vec{R} \times \vec{\Omega}_a$

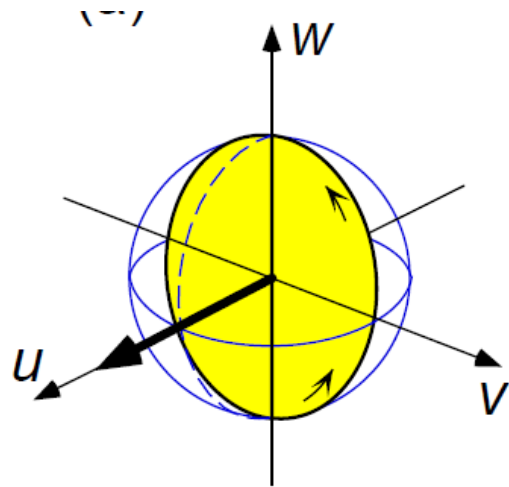
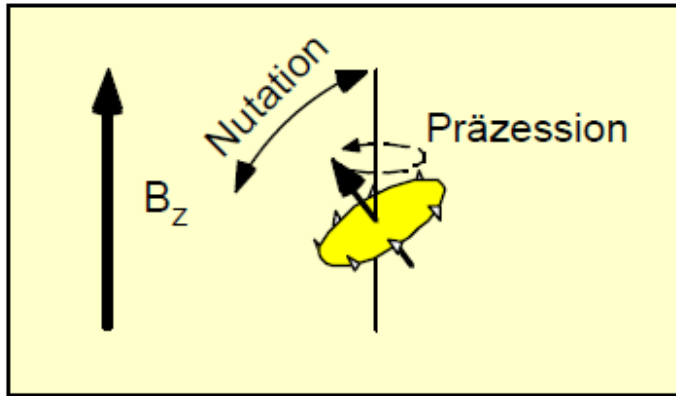
**with:**  $\vec{R} = (u, v, w)$  ,  $\vec{\Omega}_a = (\Omega_R, 0, \delta)$

# Bloch-vector

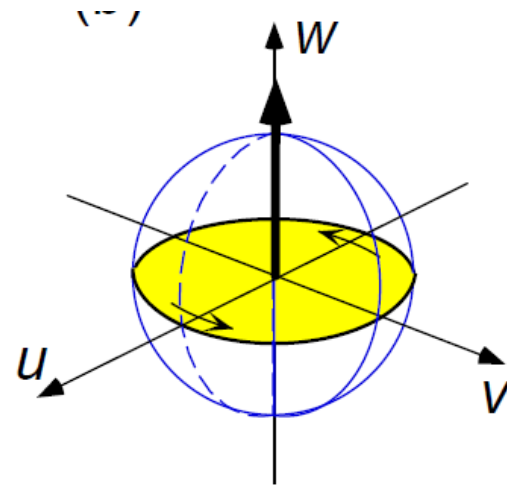


**Fig. 9.9** The Bloch sphere. Coherent superposition states lie on the surface of the sphere, with their state defined by the angles  $(\theta, \varphi)$

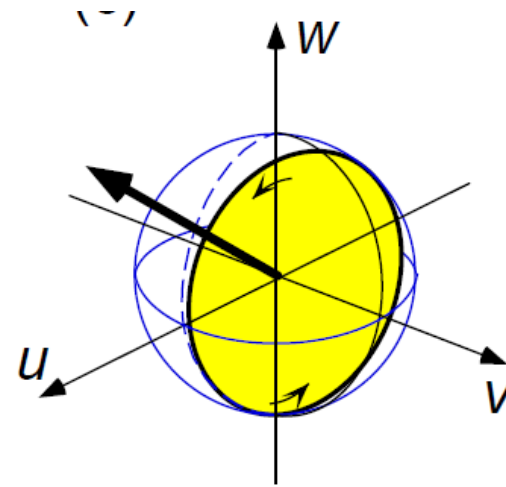
# Bloch-vector: precession and nutation on the Bloch sphere



Resonant Rabi oscillations



No (near-resonant)  
light field present



Detuned Rabi oscillations

# Rabi-oscillations for different $\delta$

