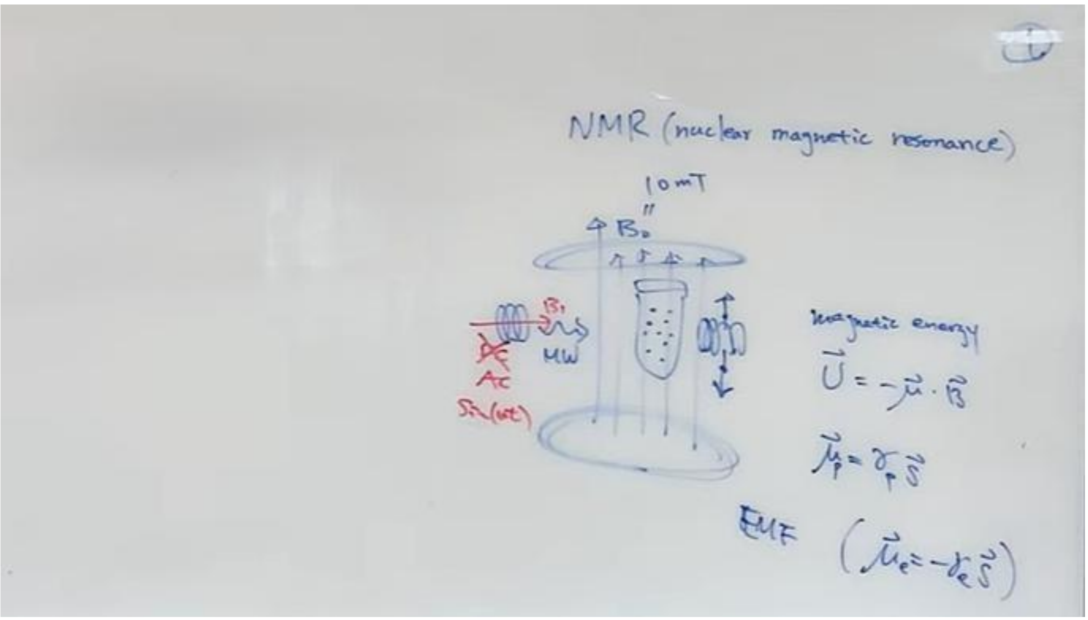
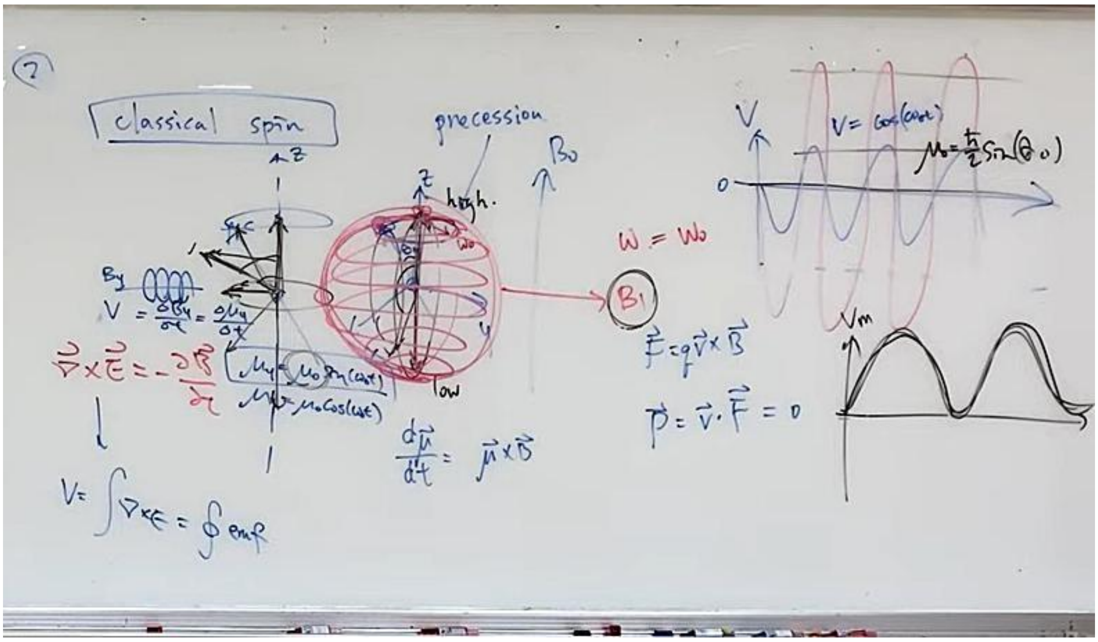
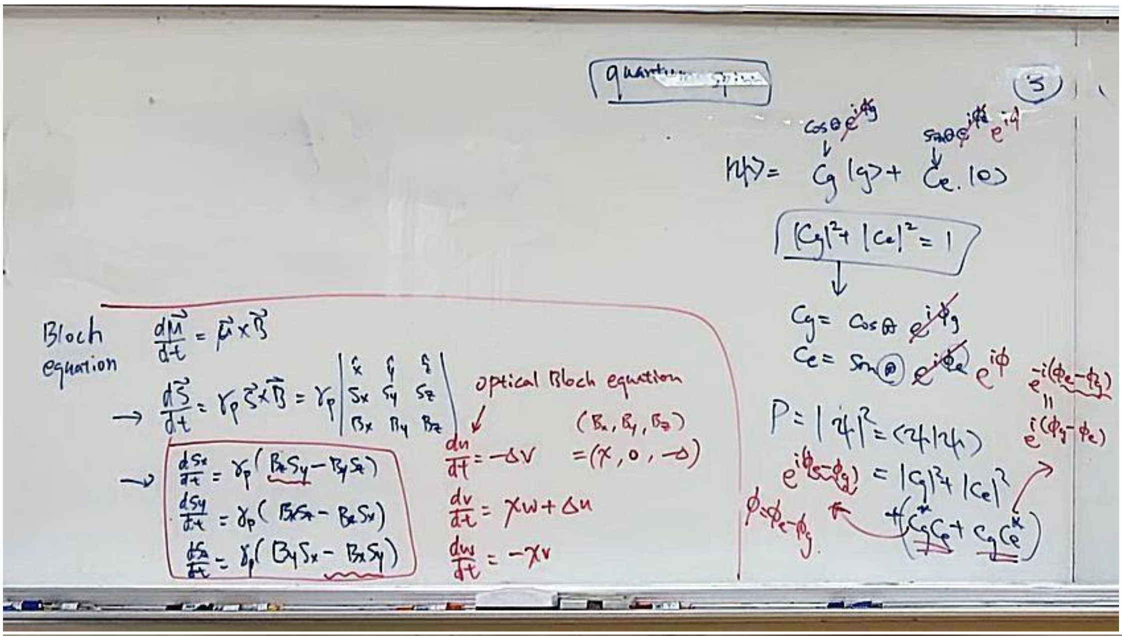
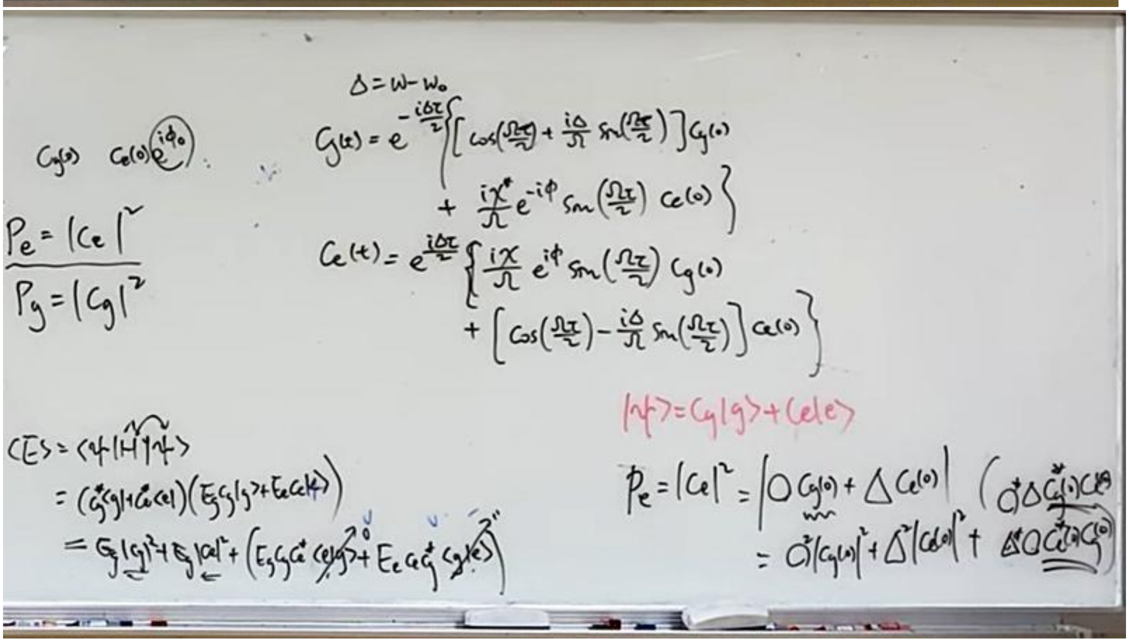
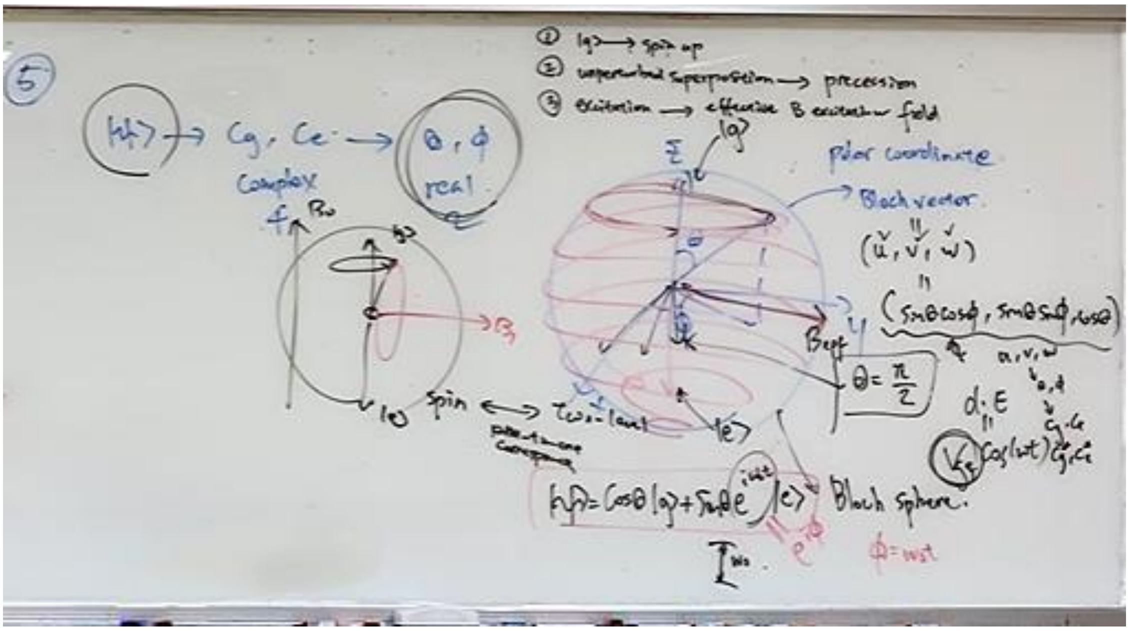
Lecture9 Classical and quantum spin

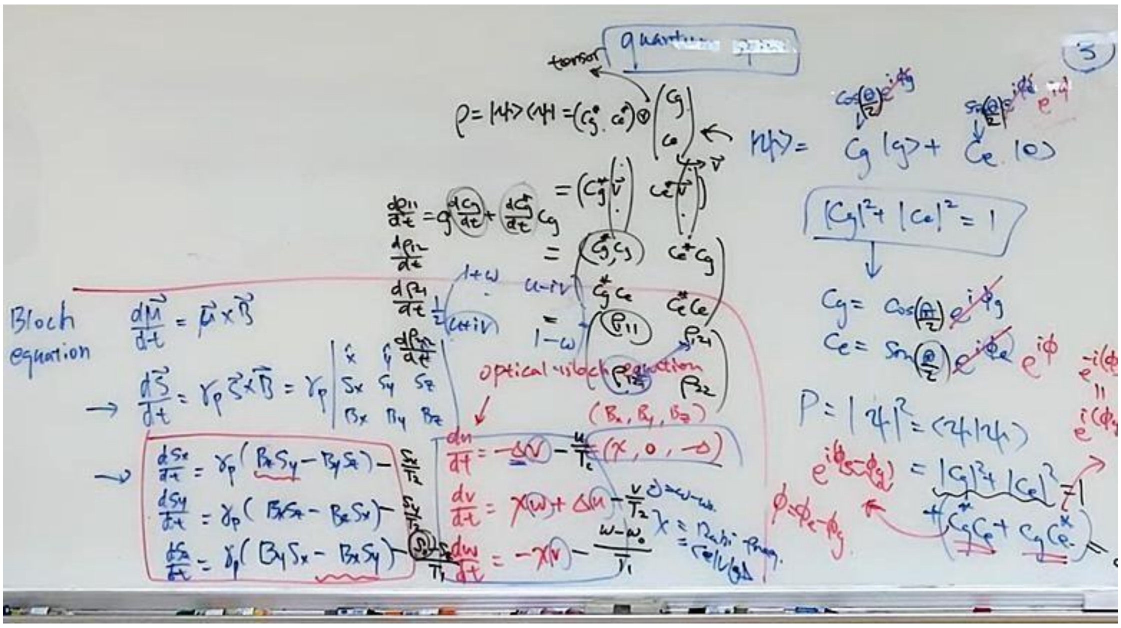


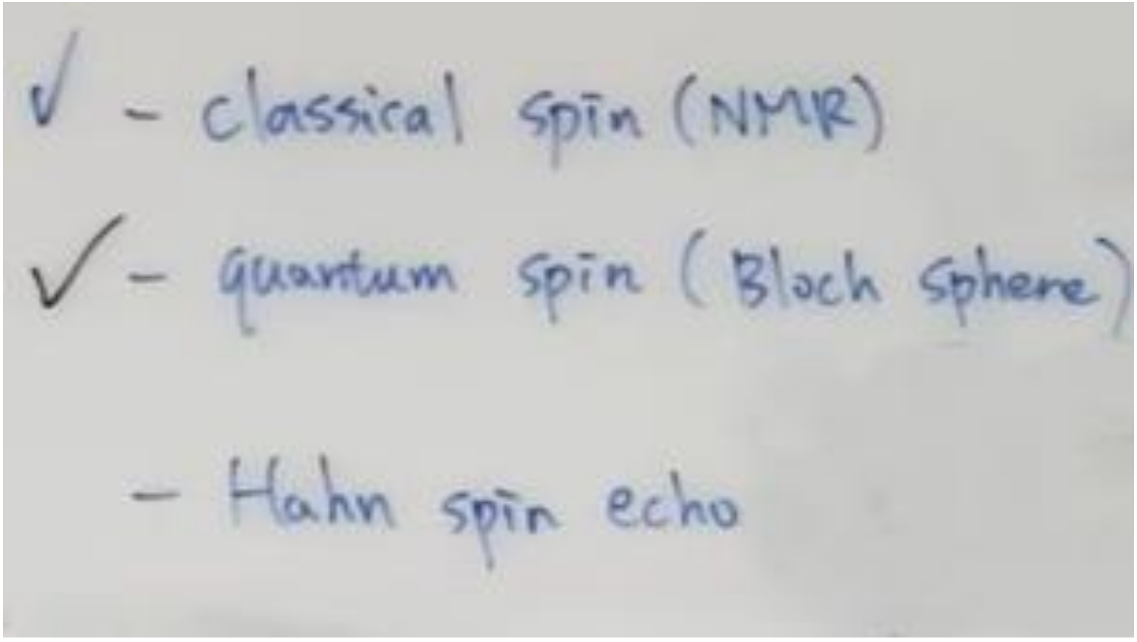



5
|ψ> = Cg |g> + Ce |0>
|Cg|² + |Ce|² = 1
Cg = cosθ e^{iφg}
Ce = sinθ e^{iφe} e^{iφ}
P = |ψ|² = <ψ|ψ>
Bloch equation
dM/dt = μ × B
dS/dt = γp S × B
dSx/dt = γp(BzSy − BySz)
dSy/dt = γp(BxSz − BzSx)
dSz/dt = γp(BySx − BxSy)
optical Bloch equation
du/dt = −Δv
dv/dt = χw + Δu
dw/dt = −χv
(Bx, By, Bz) = (χ, 0, −Δ)


Δ = ω − ω0
Cg(0) Ce(0) e^{iφ0}
Pe = |Ce|²
Pg = |Cg|²
|ψ> = Cg|g> + Ce|e>
<E> = <ψ|H|ψ>


5
① |g⟩ → spin up
② unperturbed superposition → precession
③ Excitation → effective B excitation field
|ψ⟩ → Cg, Ce → θ, φ
complex
real
polar coordinate
Bloch vector
spin ⟷ two-level
Bloch sphere.
φ = ωst


5
tensor
Bloch equation
optical bloch equation
|Cg|² + |Ce|² = 1


√ - classical spin (NMR)
√ - quantum spin (Bloch sphere)
- Hahn spin echo