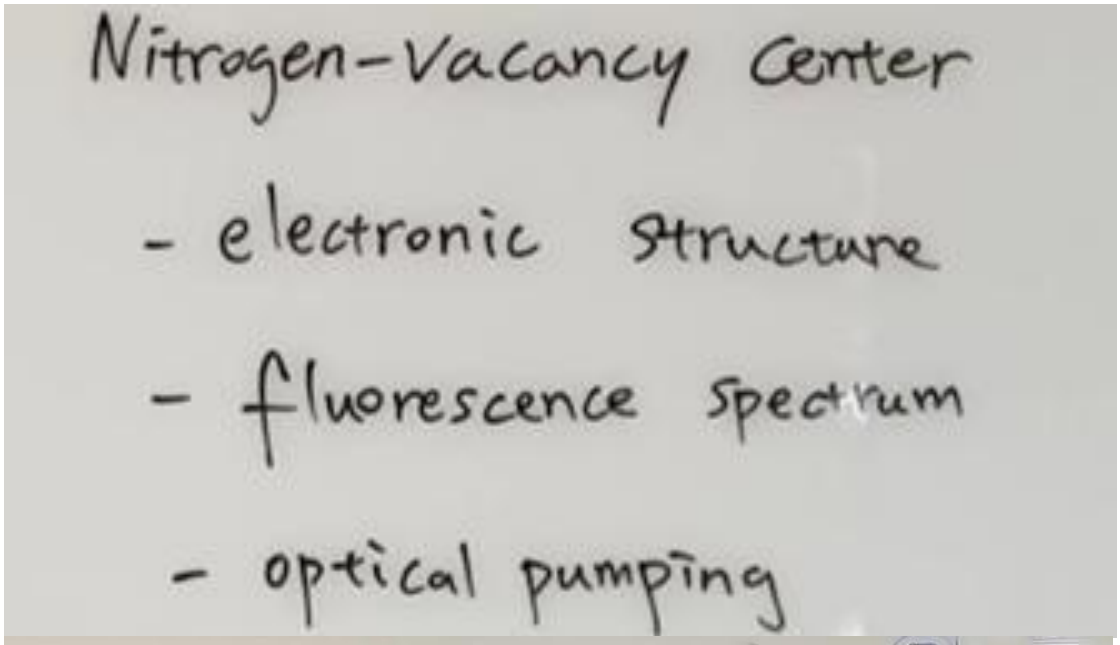
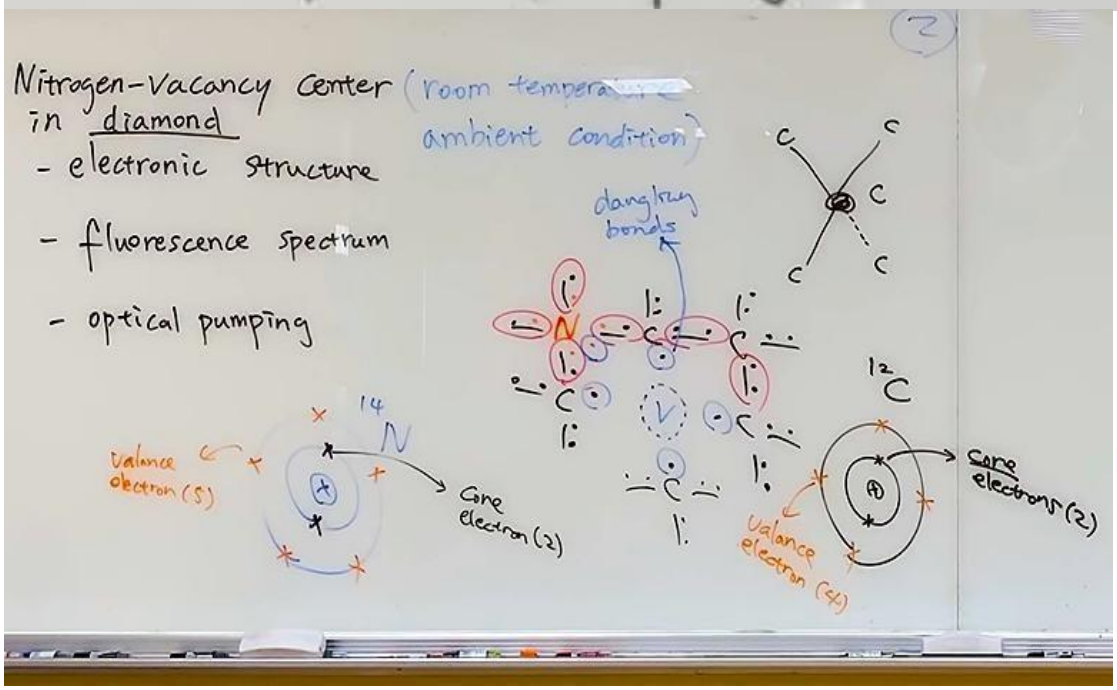
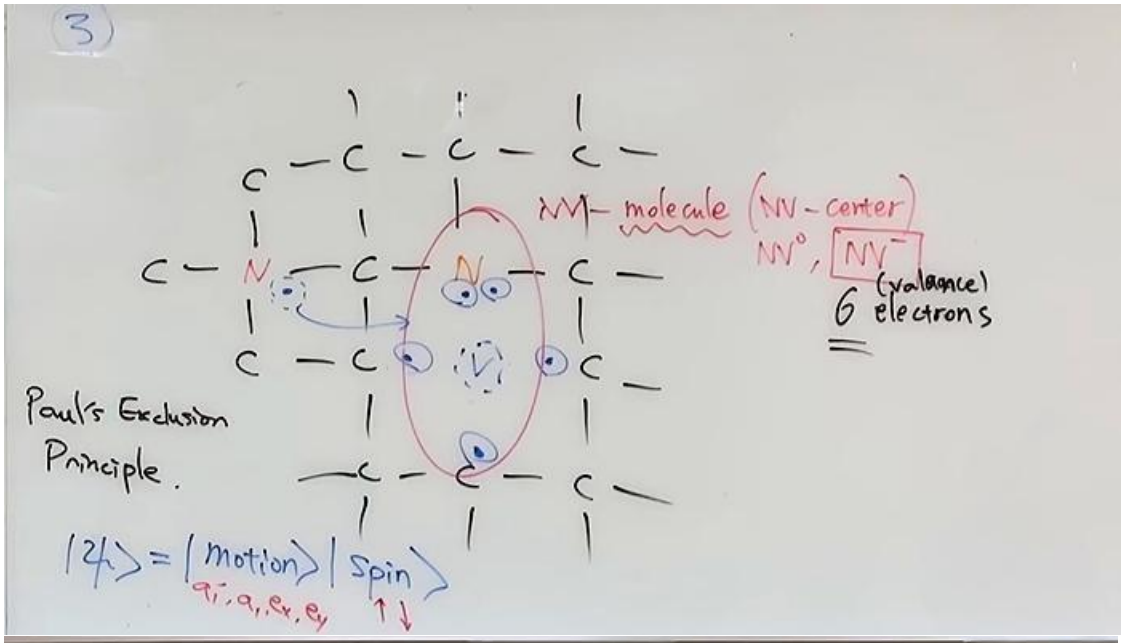
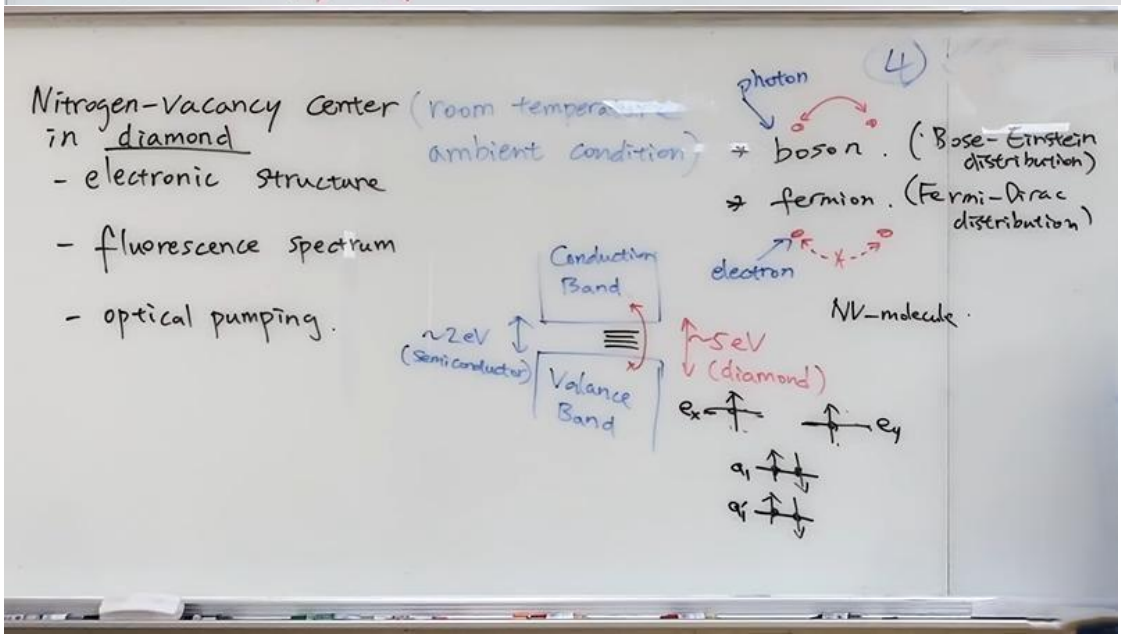
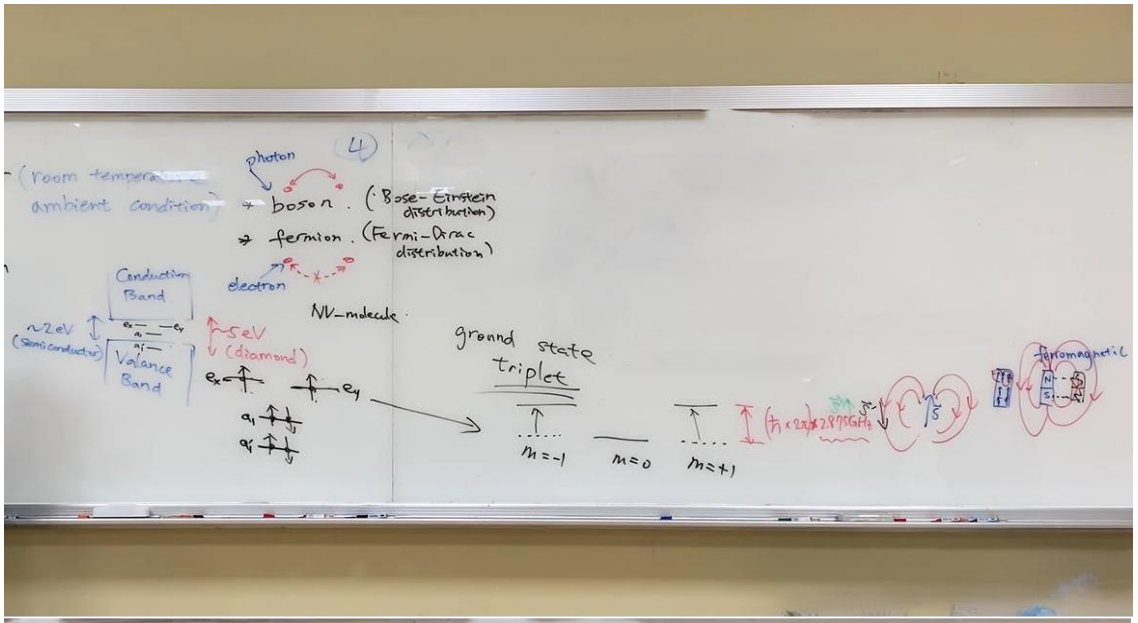
Lecture2 Nitrogen-vacancy center in diamond

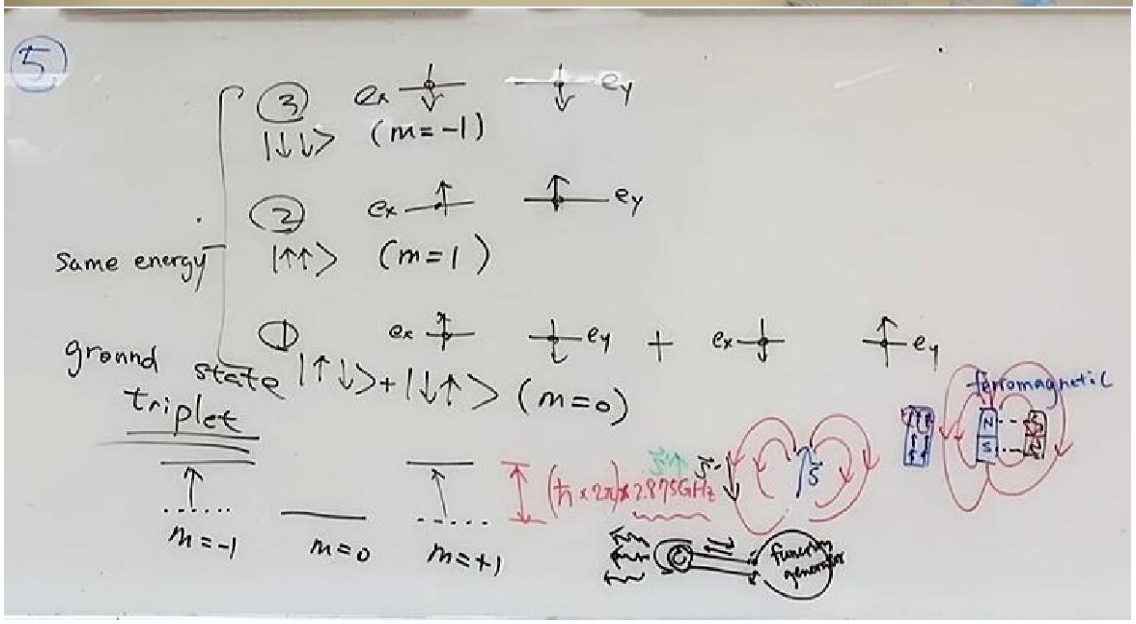


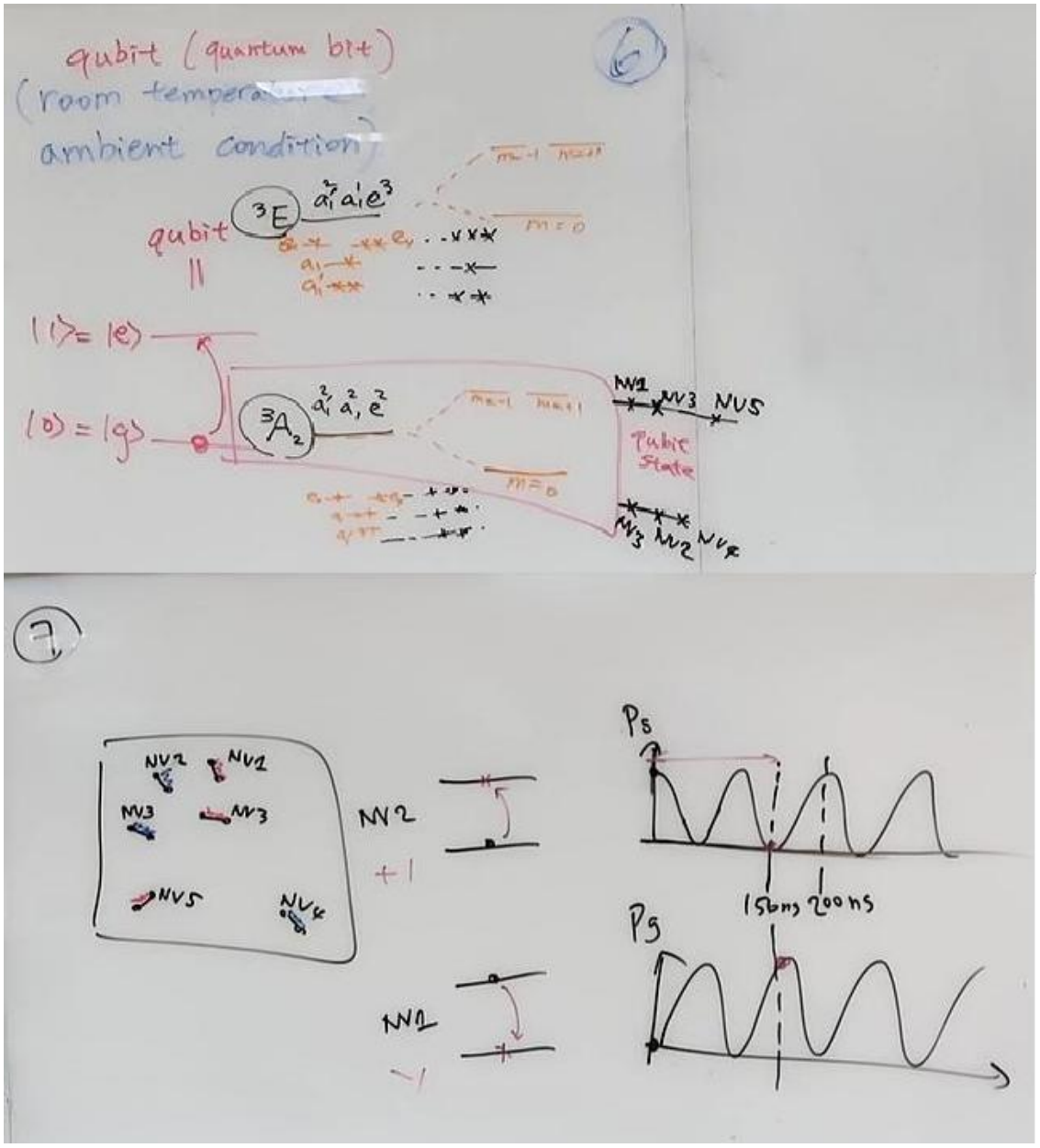


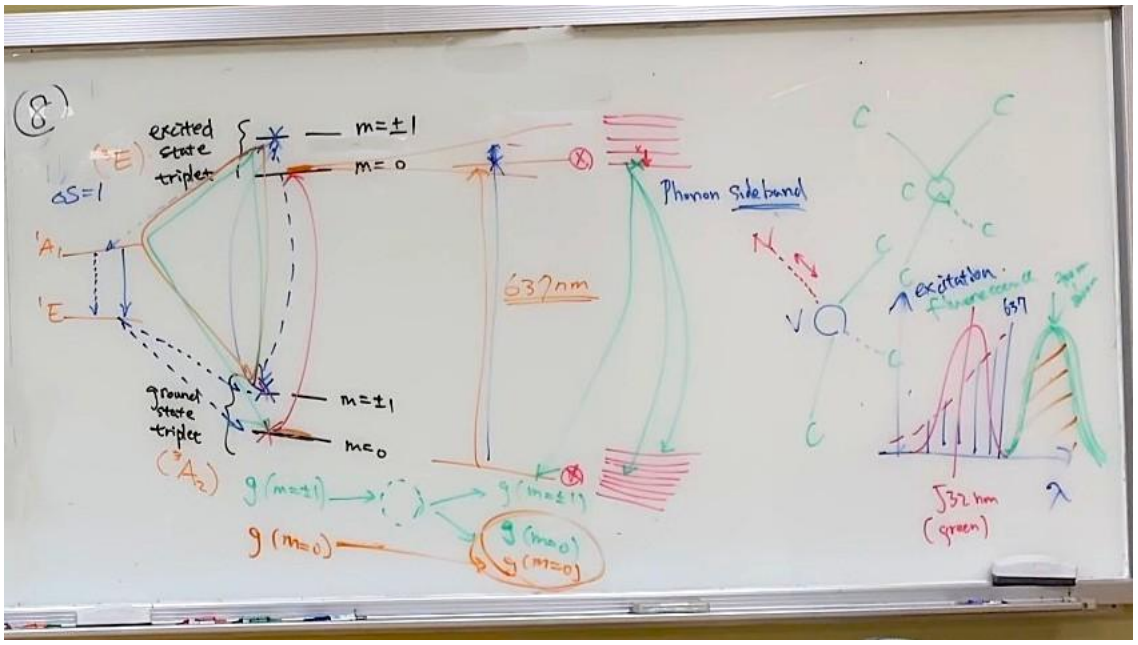

3
NV- molecule (NV- center)
NV°, NV⁻
(valance) 6 electrons
Pauls Exclusion Principle.
|Ψ⟩ = |motion⟩ |spin⟩
qi, q1, ex, ey


Nitrogen-Vacancy Center in diamond
- electronic structure
- fluorescence spectrum
- optical pumping.
(room temperature ambient condition)
4)
photon
* boson. (Bose-Einstein distribution)
* fermion. (Fermi-Dirac distribution)
electron
NV-molecule.
Conduction Band
~2eV (Semiconductor)
Valance Band
~5eV (diamond)
ex
ey
q1
qi


photon
4
(room temperature
ambient condition)
boson. (Bose-Einstein distribution)
fermion. (Fermi-Dirac distribution)
electron
Conduction Band
Valance Band
~2eV (Semiconductor)
NV-molecule
~5eV (diamond)
ex
ey
a1
a2
grand state
triplet
m=-1
m=0
m=+1
ferromagnetic


5
3
|↓↓> (m=-1)
2
|↑↑> (m=1)
Same energy
grand state
triplet
|↑↓>+|↓↑> (m=0)
ferromagnetic
m=-1
m=0
m=+1


qubit (quantum bit)
(room tempera...
ambient condition)
qubit
||
|1>= |e>
|0> = |g>
NV1 NV3 NV5
Qubit State
NV3 NV2 NV4
NV2
+1
NV1
-1
Ps
Pg
150ns 200 ns


excited state triplet
m=±1
m=0
ΔS=1
Phonon Sideband
637nm
ground state triplet
m=±1
m=0
excitation
637
532 nm
(green)