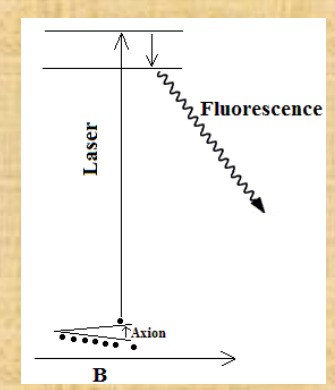
Two possible pumping schemes

One vis photon

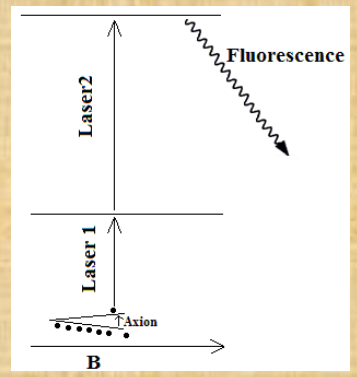


drawback

Larger linewidth

Interlevel relaxation

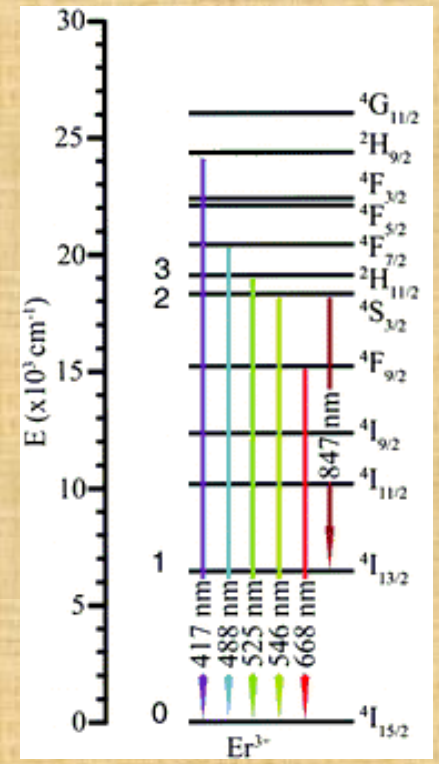
Two IR photons



drawback

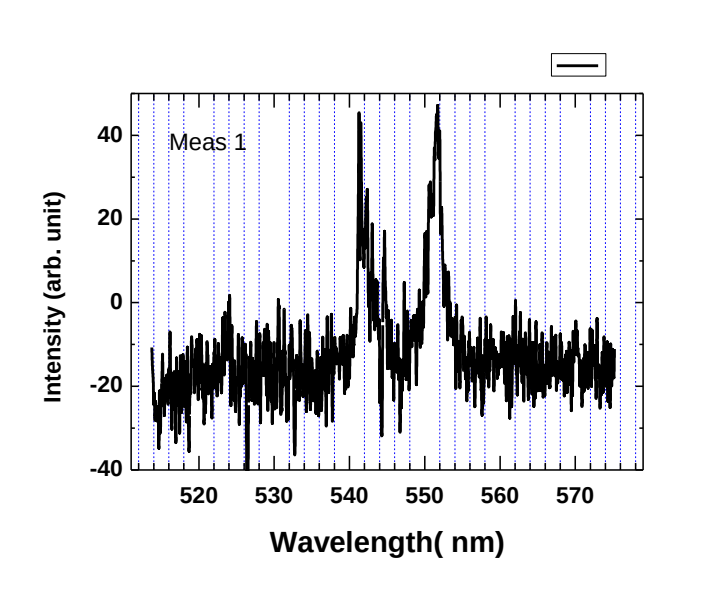
- Complexity due to more levels zeeman splitting
- Double resonance
- Low efficieny (intrinsec and external)
- Two laser sources

Erbium energy levels

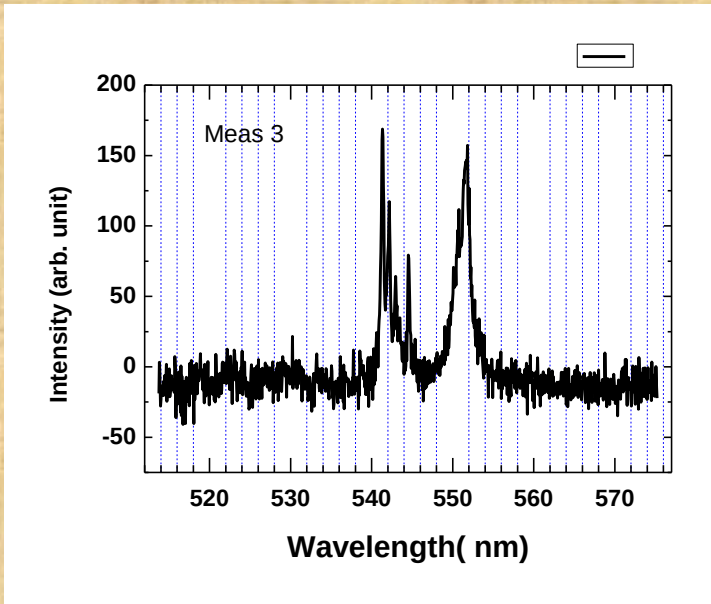


One vis photon

Excitation ~ 410 nm



Excitation ~ 450 nm



Input = 2.0 mm; Exit = 0.2 mm; Intermediate = 0.3 mm

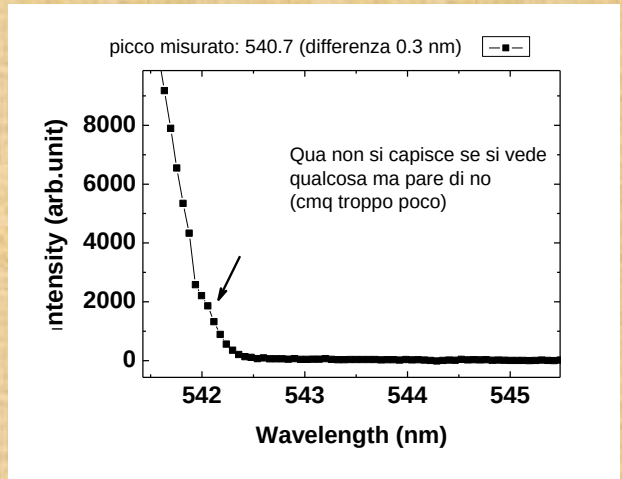
60 sec acquisition

Pw 120

Room temperature and 1% doped Er: YLF

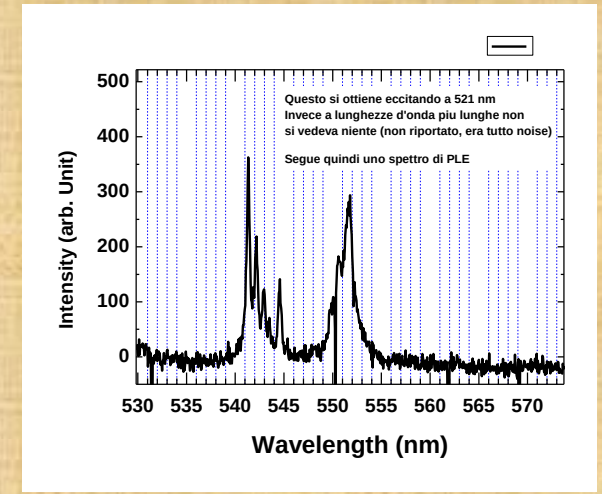
Same measurement exciting at ~ 670 nm $({}^4I_{15/2} \rightarrow {}^4F_{9/2})$ but neglegible emission

Excitation 541nm $^4I_{15/2} \rightarrow {}^4S_{3/2}$



60 sec Pw 8

Excitation 520 nm $^4I_{15/2} \rightarrow {}^2H_{11/2}$



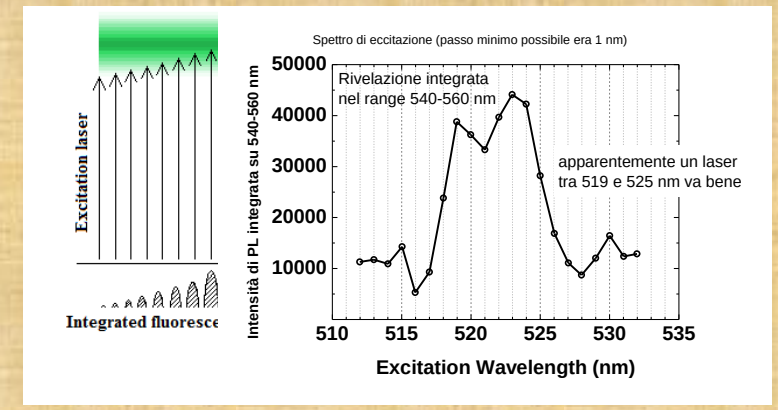
60 sec Pw 40

$(^4I_{15/2} \rightarrow {}^2H_{11/2})$ Is the best transition among the investigated transitions

Efficiency, slope (can be improoved with doping and temperature)

⇩

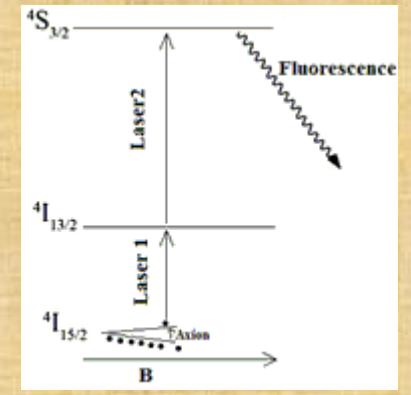
Absorption measurements in Pisa



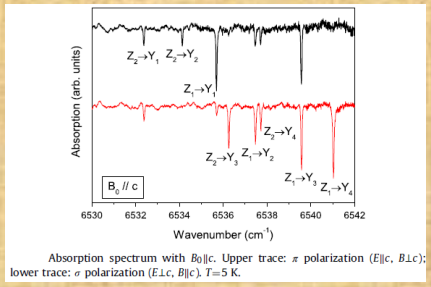
PLE measuremet
(low resolution, room temperature)

remaining $(^2H_{11/2} \rightarrow {}^4S_{3/2})$ relaxation

Two IR photons



IR transition are extremly narrow



Absorption spectrum with $B_0 \| c$. Upper trace: π polarization ($E \| c$, $B \perp c$); lower trace: σ polarization ($E \perp c$, $B \| c$). $T = 5$ K.

Journal of Luminescence 169 (2016) 478–482

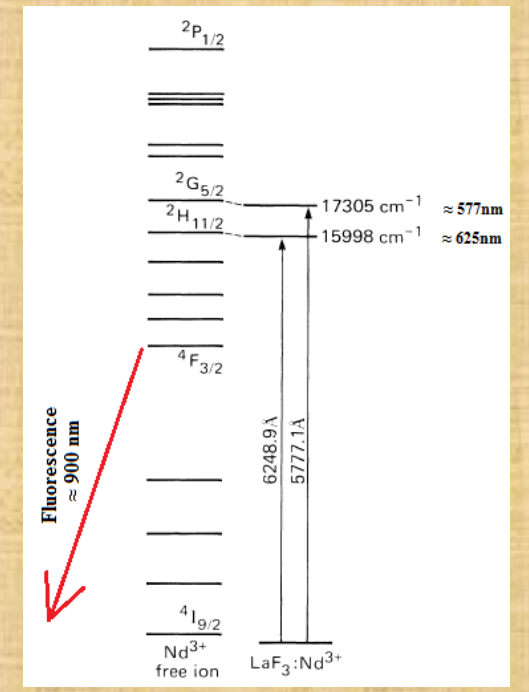
The second transition $^4I_{15/2} \rightarrow {}^4S_{3/2}$ can be large

Some measurement has already been performed …

⇩

Some pm width,
very low double resonance at 840 nm

$LaF_3:Nd^{3+}$



625nm transition
2.4 GHz linewidth

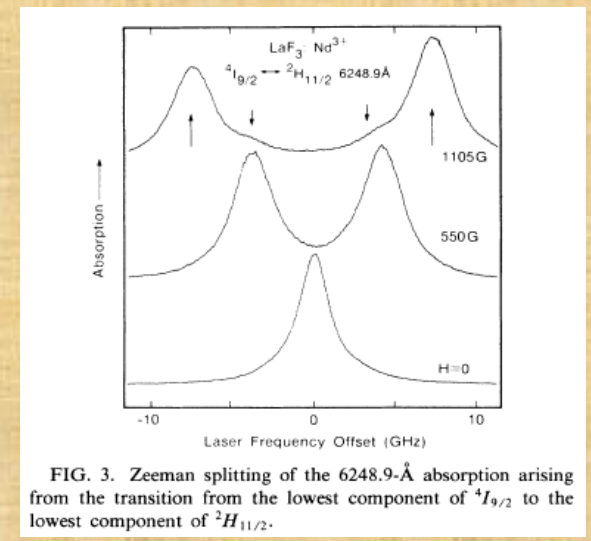


FIG. 3. Zeeman splitting of the 6248.9-Å absorption arising from the transition from the lowest component of $^4I_{9/2}$ to the lowest component of $^2H_{11/2}$.

Optical transition

R. M. Macfarlane, PRB, vol. 36, n. 7 (1987)

The shape of 577nm transition is not shown but the reported inhomogeneus linewidth is about 3 GHz (50 ppm, 1.6 K)

YSO

Crystals

Er: YLF 1%
Er: YLF 0.01%
Er: YSO 0.1%

} One 520 nm photon

} Two IR photons 1.500nm and 840 nm

Nd: YSO 1% } One 625 nm photon

Post Doc

May 24 final exam

Laser

1500nm laser ⟶ to perform low temp spectrum

840 nm laser ⟶ to be purchased

Thank you !

$$M(eV)=10^{(-5)}eV*x(GHz)/(2.42GHz)$$