Semester S1 – Fundamentals of coherent optics

Fiber amplifiers, tutorial #2

1. Using Figure 1, where red arrows show the various lasing transitions in several rare earths, calculate the mean fluorescence wavelength and the energy in eV associated with each laser transition.
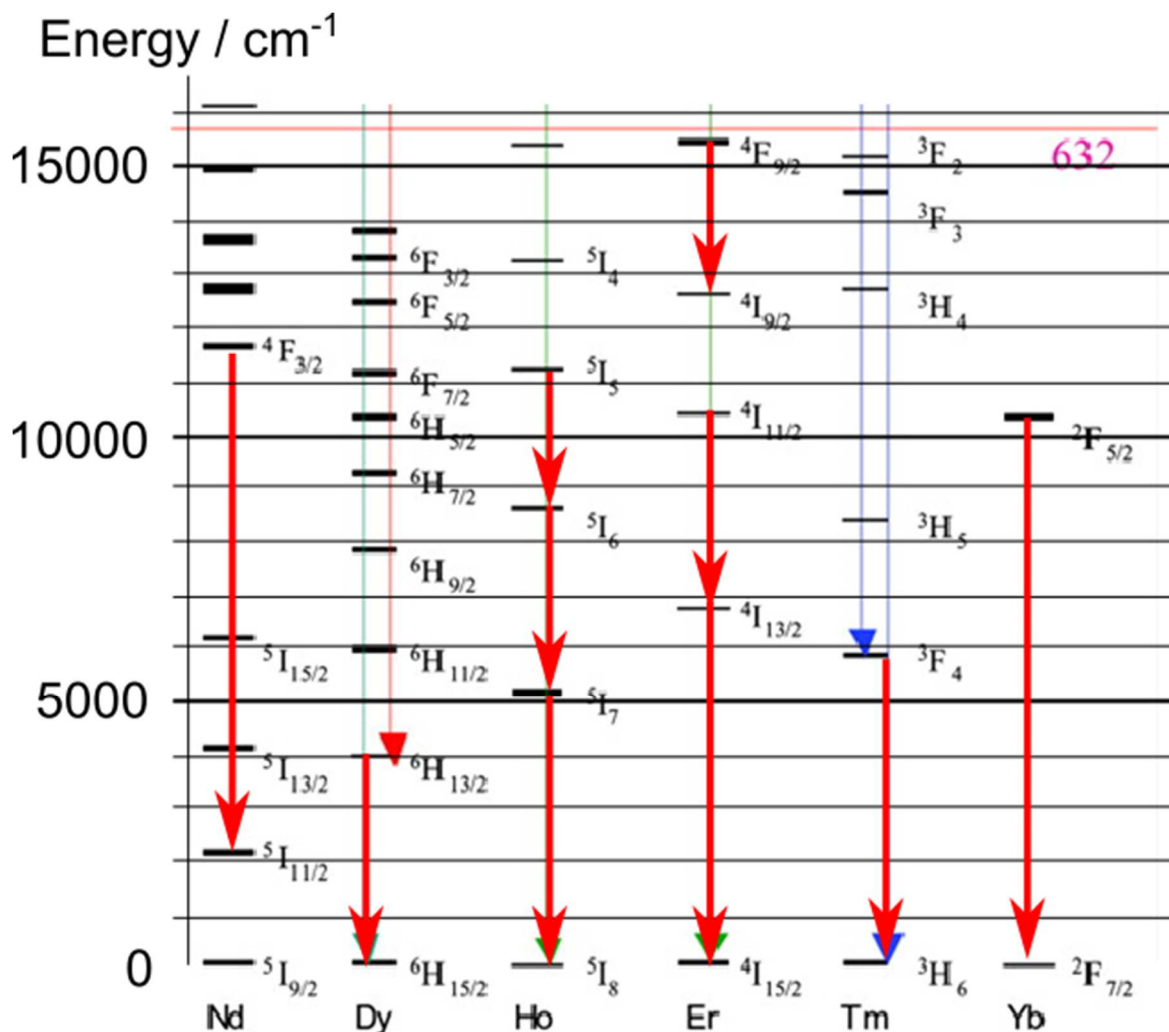

Figure 1: Detailed energy diagram of rare earths used in the fabrication of fiber lasers and amplifiers. Red arrows show the lasing transitions. Adapted from M. J. Dejneka *et al.*, Rare earth-doped glass microbarcodes, *PNAS* January 21, 2003 100 (2) 389-393.

2. Label the fluorescence spectra in Figure 2 with the name of the rare earth and the levels involved in the laser transition. Add a second horizontal axis expressed in eV, a third one expressed in cm^{-1}.
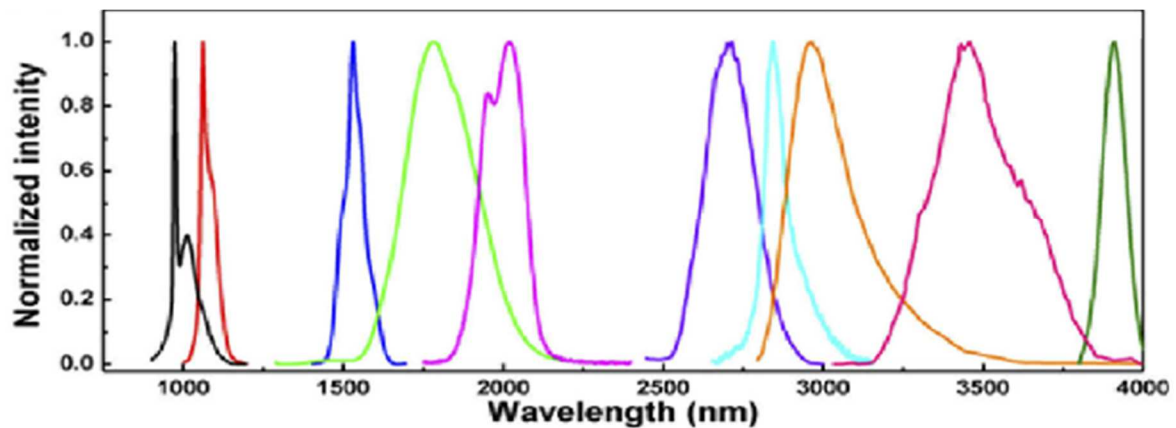

Figure 2: Typical luminescence spectra or emission bands for different RE^{3+}. From S.D. Jackson and R.K. Jain, Fiber-based sources of coherent MIR radiation: key advances and future prospects (invited), *Optics Express* Vol. 28, No. 21, pp. 30964-31019 (2020). MIR stands from mid-infrared, the region of the electromagnetic spectrum spanning from 2 to 30 µm.

Question 2 – Correction