

1. Why is NLO taught at master's degrees and not in schools, bachelor's degree...?
2. Write down the expression for the linear polarization in time-domain in the most general case. What does time-invariance stand for? And locality in space?
3. Write down the expression for the second nonlinear polarization in time-domain. I first wrote the vectorial relationship and afterwards, he asked for the same relationship but for a given component of the polarization.
4. Why is it convenient to introduce complex time-domain amplitudes?
5. He showed me the nonlinear wave equation once the SVEA has been taken into account and asked about the dependence of the complex amplitude on space, time and the frequency. He also asked why do we consider SVEA at all and how the wave equation can be further simplified.
6. What is phase-matching? Why is it necessary? How can we the phase-matching condition be fulfilled? I answered different possible techniques and then, he asked for the details of Type-2 phase-matching: In which cases is it appropriate? Could you write down how the phase-matching condition looks like for a negative uniaxial crystal? Could you draw it in a graph where the refractive index is displayed as a function of the wavelength? WAVELENGTH; NOT FREQUENCY! Be aware!
7. When cannot the previous techniques be applied? Which technique do we use then? How is this technically accomplished?
8. What is an OPA? And a Raman amplifier?
9. What is a soliton? After my answer, he asked about SPM and GVD in depth. About SPM: I wrote down the ansatz to the NLSE in order to justify the phase shift introduced by the nonlinearity. From that, I justified in which way the frequency shift is related to the time derivative of the nonlinear phase shift. He finally asked me to draw all related graphs. About GVD: What is the effect of GVD on a Gaussian pulse? Which is the physical meaning of an instantaneous frequency?
10. Which particular shape do solitons have?
11. If the pulse duration is decreased, what do we need to do so that both effects are still compensated?

The atmosphere was relaxed. Feel honored to be in his presence and surrender to his power; only then your heart will beat of pure joy.

ACHTUUUUUUUUUNG!!!!

Further questions that were asked that day and that are worth mentioning:

1. Where does the $\frac{1}{2}$ factor in the electric field ansatz for the nonlinear wave equation come from?
2. In the case of lithium niobite, the component r_{43} is bigger than r_{33} . Why then do we use r_{33} ?

NOTE: know the difference between combinations and permutations with regards the dependence of the susceptibility tensor on the frequencies.