Final assignment Nanophotonics course 2020

Assignment:
You are organized in teams of two, to jointly produce a brief essay that addresses a 'key question' that you will find listed below together with the team assignment. The idea of this assignment is that you start by reading a set of papers. They are provided through the links below. Next, on basis of the papers together you discuss the key question as posed for your team. Finally, you write an essay that presents and answers/discusses the key question, using the papers as illustration.

Grading:
First, we grade your jointly prepared essays with a single grade. Next, we schedule ca. 10 min. ZOOM interviews with each of you individually where we quiz you briefly about the essay. This provides an individual differentiation of the grade (e.g. – you can earn an additional top up to the mark!)

Timeline:
- The assignment is **handed out on May 13, and handed in on May 27 by 18:00 hrs** as PDF that you can e-mail to f.koenderink@amolf.nl
- The short orals are scheduled by default on May 29 [morning is our reserved exam slot] – you will be contacted to set the appointment.

Expectation for the essays:
1. Length 1000-1200 words (excl. captions, 150 wrd abstract, author statement)
2. Up to four display items, i.e., figures, to illustrate your point of view on the key questions
3. The essay has the following constituents
   a. Introduction to explain what *is* the research question and why it is important in the wider context of nanophotonics
   b. In as far as needed, a brief theoretical background to explain those aspects that you need to explain your answer to the key question posed to you, and the evidence that the paper set offers
   c. Brief discussion of the results of each paper in as far as they help to elucidate the answer to the key question posed to you
   d. Importantly: your viewpoint/answer on/to the key question asked.
   e. A < 150 word 'author statement' - explaining how you distributed the tasks and tackled the assignment.

Resources and tips:
1. The essays focus on the question – the papers provide illustrations, evidence, and viewpoints. It is certainly impossible and unnecessary to discuss all the points and figures of each paper.

2. What we are looking for is that you understand how the key question connects to basic concepts from the lecture, and also to trigger you to think *beyond* the lecture material and develop new viewpoints. The essay is *not* a mere summary of the two papers.

3. Therefore: work together! This is the best way to come to new viewpoints, and the most fun. Don't stitch two independent bits, each a summary of a paper together just before the deadline.

4. You can use any additional literature you may want to use, and you may consult any of the TAs or teachers

5. You may notice that 1200 words, about 4 display items and one or two equations is about the same as a joint 10-minute presentation. This is a good way to think about the challenge: imagining / sketching out those powerpoint slides is a great way to storyboard.

Please report if the links do not work (f.koenderink@amolf.nl)

Team		Question	Source Link
1	Bas Mitch	It is well known that thermal sources (black body emission) like a halogen lamp generates incoherent emission - unlike coherent sources such as lasers. Additionally, the blackbody spectrum is described by the well-established Planck's law. How does the Greffet paper then manage to claim coherent emission from a hot object? How is it possible that both the emission angle and spectrum are claimed to be controlled, as claimed in the Fan paper?	Greffet coherent thermal emitter Fan passive radiative daytime cooling
2	Thomas Vashist	Band structures and dispersion relations are everywhere in physics – photons, electrons, phonons… How do you measure one directly? Summarize the methods in the paper. Which of these methods uses parallel momentum conservation? Which of these methods can look beyond the light line? How is that possible without an NSOM?	Fourier Folding Bands Lasing lattices (Focus on the dispersion, ignore the lasing) Nanowire dispersion
3	Evelijn Jop Toon (**1600 wrds**)	Explain Stochastic Optical Reconstruction Microscopy (STORM), Stimulated emission depletion (STED) microscopy, and the scattering lens. Which of these methods does not actually break the diffraction limit at all? Which of these methods cheats instead of beats the Abbe limit?	STORM STED Scatteringlens
4	Hanne Jelle	Changes in the environment of a physical system (e.g. plasmonic structure, cavity, etc) can be translated into shifts of the system's resonances. Explain how this property is used in the linked papers. How does sensitivity relate to polarizability and Purcell factor? Which system should have best sensitivity?	Plasmon sensor Vollmer

5	Alparslan Rolain	Coupled oscillators usually give rise to anticrossing of eigenfrequencies. With precise control over loss, gain, and complex coupling, you can also engineer so-called *exceptional points*". Explain how cavities with loss and gain map on coupled oscillators. On basis of *exceptional point* physics how you get *better lasers by adding loss*.	WGMOzdemir BrandstettEPlaser
6	Vera Philip	Optically resonant nanoparticles strongly scatter light analogous to electric dipoles. Accurate control over the geometry enables 180-degree control over the phase of the scattered light. How is it then possible that silicon nanodisks scatter like magnetic dipoles despite the fact that silicon is non-magnetic? How can the authors claim to have 360 degree phase control of the scattered light? And how is it possible that the scattering by a nano disk array is unidirectional?	Decker nanodisks Staude directional

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