PH431 class project: special beams

The idea of the final project is to give you a chance to work with your colleagues and get some practices about presenting and reporting.

As a starting point, you will find the attached papers useful.

Components of the project:

Core results: E and B field, intensity (energy density distribution), phase profile, Poynting vector

Presentation: find 2 best speakers to represent your team.

First person, 10min of literature research, you can pick up two papers and elaborate how they use the beam or create the beam for something cool. This is your own choice.

Second person, 10min of your result, including mathematical background (ie. The equations you have used); methods (briefly how you calculate and plot); visualization (core results, notice that you need to find a nice way of visualizing vectors); physics interpretation (eg. how is your calculation related with the research you mentioned earlier, where the energy is flowing to etc.)

Contribution statement: normally the final slides. Example, who did literature research, who did calculation, visualization etc.

The presentation will be graded from the rest of the class (not including me) for a maximal of 15pt.

Here is a breakdown of the 15 pt:

Is the presentation overall well organized: 3pt

Are the speakers capturing the main ideas of the research articles? 3pt

Is the visualization enough to show us the result? 3pt

Is there time management reasonable during the presentation? 3pt

Have the audience learned something, feeling it boring/attractive? 3pt

- Written report:

Typically 3-5 pages, but can be longer if you include big figures.

Must be in pdf format.

Should include the background, literature research, all equations you have used, citations.

Must contain the core results and discussions about it.

Must have a contribution statement.

You can use templates from PRL, Nature etc.

The written report is due Monday of the dead week 6pm by email.

The written report will be graded by the instructor for a maximal of 15pt.

The grades of final project is the average of written report and presentation.

Here are the teams, and assignment of the topic

For Bessel beams we will use the label l from $\vec{A} \propto J_l(k_s s)\exp(il\varphi)\hat{x}$, $\vec{A}$ is the vector potential. Notice that for Bessel beam of higher orders you can refer to

http://www.osa-opn.org/home/articles/volume_24/june_2013/featurres/unraveling_bessel_beams/#.Unq1VPmkqQB

For Optical vortexes, we will use the label l and p from $\vec{A} \propto L_P^l$.

You can find these notations and more information from the papers attached.

Nov. 27th, first group, Optical Vortex, l = 4, p = 1, application in astrophysics

Nov. 27th, second group, Bessel beam, l=0, application in tractor beam

Nov. 29th, first group, Optical Vortex, l=10, p = 2, application in communication

Nov. 29th, second group, Bessel beam, l=1, application in optical trapping

Dec. 1st , first group, Optical Vortex, $l = 3$, $p = 1$, transferring orbital angular momentum of light to microparticles/plasma/electrons in solids

Dec. 1st , second group, Bessel beam, $l = 2$, application in light sheet microscopy