

## PHYS 416 – Project Proposals

As you may recall, an important part of this class involves a project that will entail some form of programming project. To get started on this, I am asking you to write a ~1-2 page proposal outlining what you plan to do.

- The project is worth 25% of your final grade, so you should put substantial effort into it.
- This proposal is worth 20% of the project grade (i.e. 5% of your final grade).

In the proposal, you should address the following points:

- What you plan to do and why it is a problem that is significant enough that it warrants a project as well as what physical question you plan to address.
- A plan on how you plan on proceeding, including some discussion of the equations you will need to solve as well as the numerical tools you will need to develop.
- A plan on how you intend to validate, test and document your program.
- For this project you can use MATLAB (or python, if you prefer).

*Project Timeline:*

1. **Monday, March 23, 5PM: Proposals due (Right before spring break).**
2. **March 30:** Graded proposals with comments returned.
3. **~April 20, 2020 – Projects due**
  - That week (exact dates TBD) each of you make a ~15 minute presentation of the project (including the programs) to the class.
  - You will be graded by myself and by your classmates.
  - You should structure your programs so that they are easily used and understood by someone else.

Please feel free to discuss with me what projects you have in mind doing.

## Some Previous Projects- In alphabetical order (not a complete list).

1. 2D Photonic crystal waveguide simulation
2. Aerodynamics of table tennis
3. Astrophysical fluids in a gravitational field using smooth particle hydrodynamics
4. Ballistic deposition model.
5. Band Structure Calculation.
6. Barotropic atmosphere model
7. BEC simulation
8. Brownian dynamics simulations
9. Cellular automata simulation.
10. Chaotic behavior of a drippy faucet.
11. Chaotic motion of bouncing balls on a rubber membrane
12. Charged particle in an electric field and a dipole magnetic field.
13. Chladni figures for polygonal surfaces
14. CMS pixel detector performance simulation
15. Damped motion on a string
16. Detector simulation using Monte Carlo methods
17. Earthquake and Hurricane effects on buildings
18. Electric Wave in a Dielectric Medium
19. Euler's Disc
20. FDTD Absorption Spectra modeling
21. Flight mechanics
22. General model predator-prey system
23. Generation of stellar wind line profiles
24. Geometric Optics
25. Gravitational effects of black holes in a solar system model
26. Gyroscope precession
27. Heat flow simulation
28. Impedance-based modeling of supercapacitors
29. Inverted Double pendulum.
30. Ising Model
31. Kirkwood gaps Simulation
32. Laser pulse through an optical fiber.
33. Lattice Boltzmann Simulation
34. Light Curve Modeling for a Transiting Exoplanetary
35. MHD Equilibria
36. Modeling the Human Vocal Tract
37. Monte Carlo simulation of a Hydrogen atom
38. Monte-Carlo simulation of exciton-exciton annihilation effects on photoluminescence in carbon nanotubes
39. Motion of a body inside the spherical plane
40. MRI inversion
41. N-body lipid chain system
42. N-body molecular simulations.
43. N-body pendulum
44. N-body simulation of a circumstellar disc
45. N-body solar system model, with and without collisions
46. Neural network simulation
47. Non Equilibrium Growth Simulation
48. Optical Bloch simulation with full hyperfine structure
49. Optical Properties of photonic crystals
50. Optical trap and fibre simulation.
51. Optimal profile extraction from astronomical observations.
52. Oxygen concentration on skin.
53. Particle trap simulation
54. Percolation model for the formation of the spiral arms of the spiral galaxies
55. Perihelion of Mercury's orbit
56. Physics of billiards
57. Physics of bowed strings
58. Physics of bowling
59. Physics of flying discs
60. Physics of solitons.
61. Physics of tennis
62. Physics of tides.
63. Planet formation
64. Protein folding simulation
65. Radial flow between two parallel discs.
66. Random walk simulation
67. Rocket trajectory simulation
68. Roller coaster model
69. Rutherford scattering simulation
70. Sea breeze simulation.
71. Self Assembly Kinetics
72. Simulation of growth of bacterial colony
73. Simulation of small-scale predator prey interactions
74. Single electron transistor modeling.
75. Skeet shooting modeling.
76. Solar coronal loop modeling
77. Soliton simulation.
78. Solutions to Friedman's equations.
79. Space probe simulation in a model solar system.
80. Special Relativity simulations
81. Stellar spectral lines model.
82. Stellar structures model.
83. Study of bipolar junction characteristics.
84. Supersonic flow over a flat plate
85. System Meteorite impact on water.
86. The Effects of Vibrations on Carbon Nanotube Water Filtration
87. Three dimensional spring-mass system
88. Tight Binding Simulation of 2-dimensional Material, Graphene
89. Traffic simulation
90. Two dimensional fluid flow problems
91. Two dimensional quantum simulation
92. Vibration of a weighted musical string
93. Vibration of molecular clusters
94. Visual appearance effects in special relativity
95. Wave particle interactions in plasmas.
96. Waveguide simulation
97. Waves in a 2D cavity
98. Waves in blood vessels
99. X-ray telescope simulation
100. Zeeman solver simulation

