Methods of Mathematical Physics
(Fall and Winter 08/09, 32 credits)

Program Description
A close examination of the complex and varied world around us reveals a high degree of underlying order. Our goal as scientists is to understand and explain this order and we do this most precisely using the language of mathematics. Indeed, the degree to which the universe lends itself to a mathematical description is remarkable. The goal of this advanced program is to develop the mathematical language needed to describe and create physical models of our world. To that end, we will examine a number of key physical theories and systematically develop the mathematical tools that we need to understand them.

We will begin, in fall quarter, with a detailed study of classical mechanics – the mathematical description of the clockwork universe envisioned by Newton and others who followed him. We will focus initially on linear approximations for which analytical solutions are possible. The mathematical methods we will learn for this purpose include differential equations, vector calculus and linear algebra. In winter quarter we will move beyond linear approximations and study non-linear systems and chaos and the implications of these ideas for the determinism implied by classical mechanics. We will also extend the Newtonian synthesis to the realm of the very fast and very massive by considering Einstein's theories of special and general relativity. Mathematical topics associated with these ideas include the geometry of space-time, vector and tensor calculus and variational calculus.

Syllabus
Fall: Classical Mechanics, Ordinary Differential Equations, Multivariable Mathematics, History and Philosophy of Physics
Winter: Special and General Relativity, Non-linear Dynamics, Vector and Variational Calculus, History and Philosophy of Physics.

Schedule

Monday	Tuesday	Wednesday	Thursday
9:00-12:00 Lecture/Workshop Sem II D2109	9:00-12:00 Lecture/Workshop Sem II D2109	9:00-12:00 Lecture/Workshop Lab 1 1040	9:00-12:00 Lecture/Workshop Sem II D2109
Lunch			
1:00-2:30 Seminar and Presentations Lib 2708	1:00-4:00 Computer Lab CAL West	1:00-3:00 Optional Tutorials	1:00-2:30 Workshop Lib 2708

Texts for Fall Quarter
(These will be available for much less online. Look on www.campusi.com or www.addall.com for a list of sellers).

- **TITLE:** Mathematical Methods in the Physical Sciences
  by Mary L. Boas
  ISBN: 0471-19826-9
  ISBN 13: 978-0471-19826-0
  Publisher: John Wiley and Sons Inc
  Publish Date: 2005-07-22

- **TITLE:** Differential Equations
  by Paul Blanchard, Robert L. Devaney, Glen R. Hall
  ISBN: 0495-01265-3
  ISBN 13: 978-0495-01265-8
  Publisher: Thomson Learning
  Publish Date: September 2005

- **TITLE:** Classical Mechanics
  by John R. Taylor
  ISBN: 1891-38922-X
  ISBN 13: 978-1891-38922-1
  Publisher: Univ Science Books
  Publish Date: August 2004

- **TITLE:** Isaac Newton
  by James Gleick
  ISBN: 1400-03295-4
  ISBN 13: 978-1400-03295-2
  Publisher: Random House Inc

Other Supplies
- Maple: We will be making use of the mathematics software, Maple, in the computer labs. Students can use this software in the Computer Applications Lab which is open 9:00 am -10:00 pm during the week. If you plan to do most of your work at home you should obtain the student version from MapleSoft
- Graphing Calculator with Symbolic Algebra (eg TI89)

Faculty Information
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Website
The following program website has much more detailed information and will be updated regularly.: http://academic.evergreen.edu/curricular/methods_08/