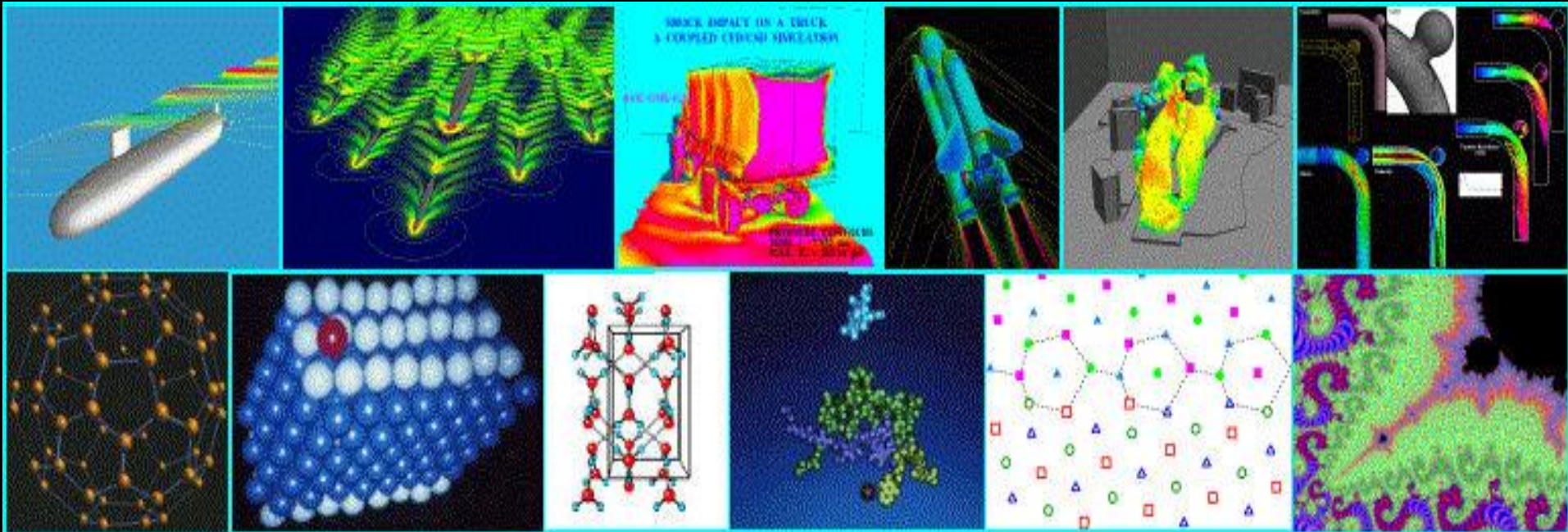# Computing for Scientists

Introduction

(Aug. 30, 2011)
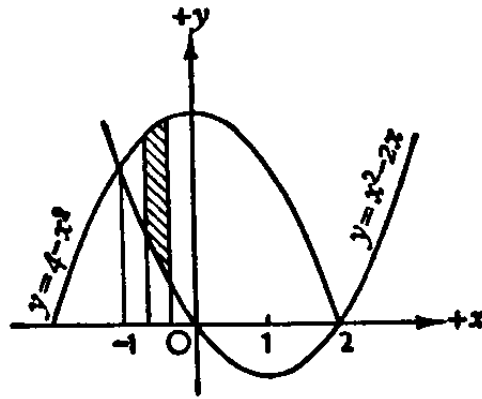

Jie Zhang

**CDS 130 - 001
Fall, 2011**

Why Computing for Scientists?

Sciences are driven by

Experiment
(~ before 1600)

Math
(After ~1600)

Computing
(After ~2000)

The goal is to gain insight

Why Computing for Scientists?

• "Experimental science is the queen of sciences"
– Roger Bacon (1214 ?- 1294?, English Philosopher)

• "Math is the queen of sciences"
– Carl Friedrich Gauss (1777 – 1855, German Mathematician)

• "The purpose of computing is insight, not numbers"
– Richard Wesley Hamming (1915 – 1998, American Mathematician)

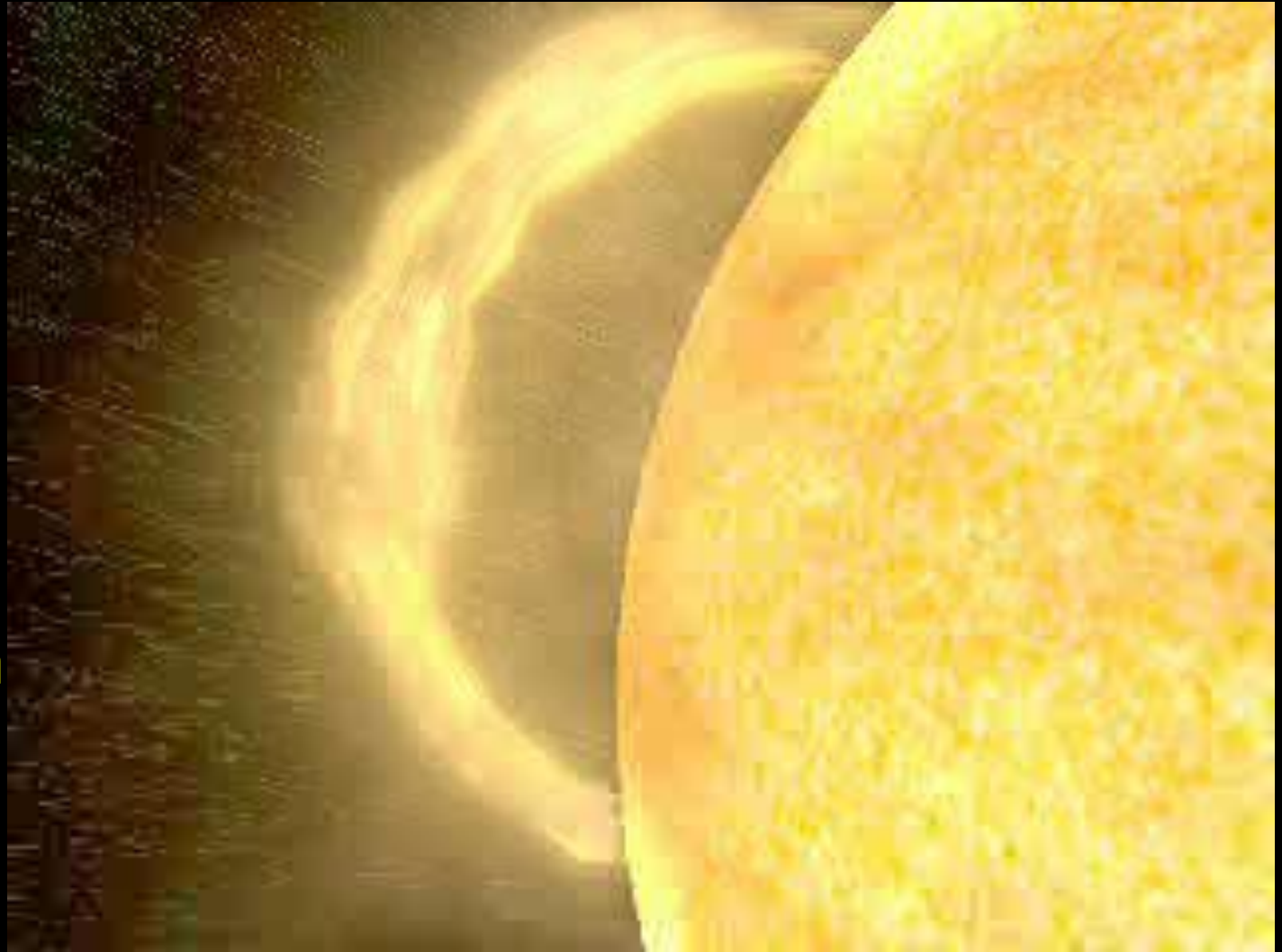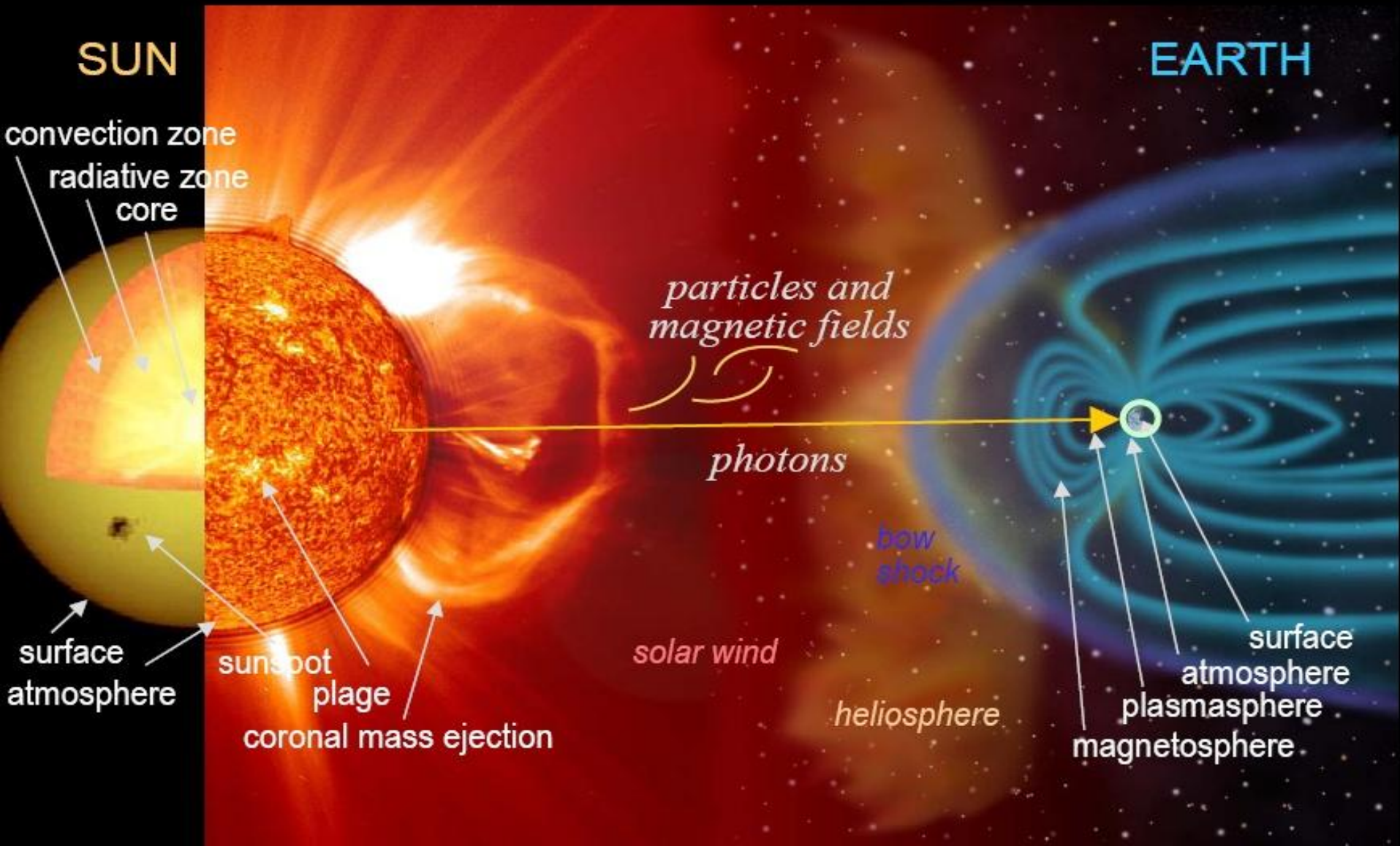# You and Me

A Space Weather Scientist

It starts from an eruption from the Sun.

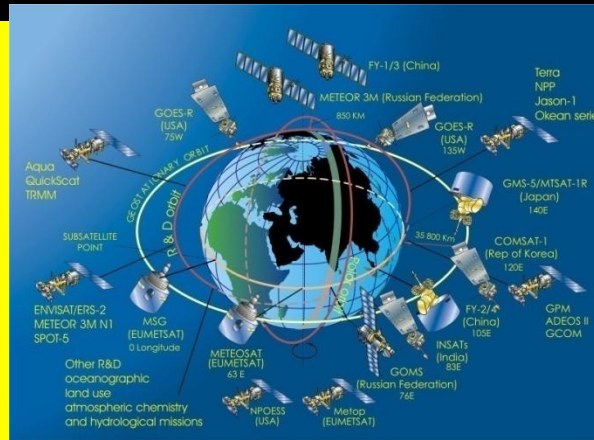Prediction depends on how it propagates

Space Weather: the Systems

SUN

EARTH

convection zone
radiative zone
core

surface
atmosphere

sunspot

plage

coronal mass ejection

particles and
magnetic fields

photons

bow
shock

solar wind

heliosphere

surface
atmosphere
plasmasphere
magnetosphere
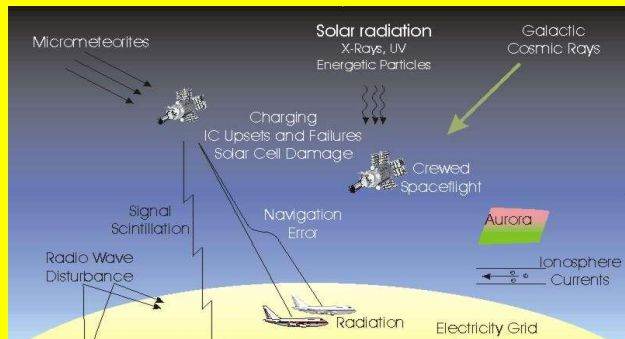
Space Weather: Effects

空间气象的危害

Human Space Exploration

Aviation
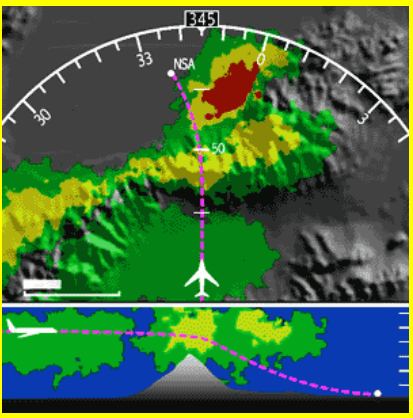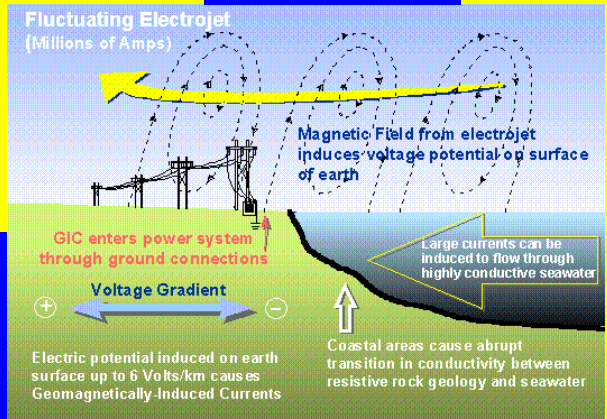
Satellite Operation

Power

Communication and Navigation
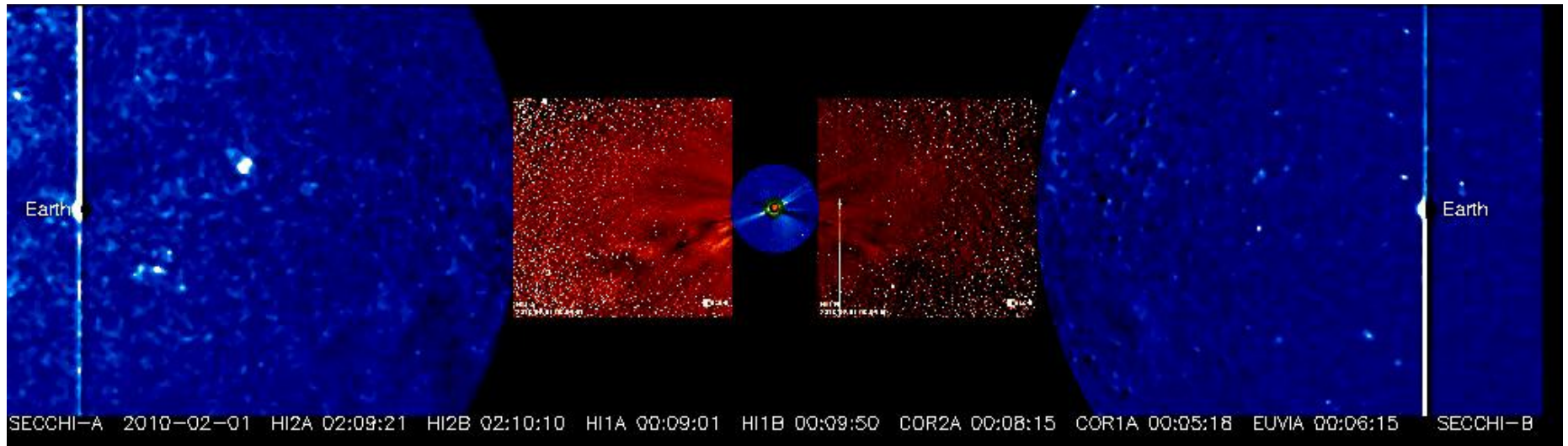
Aurora

STEREO Mission

SDO Mission

AIAflare_lg.mov

Syllabus

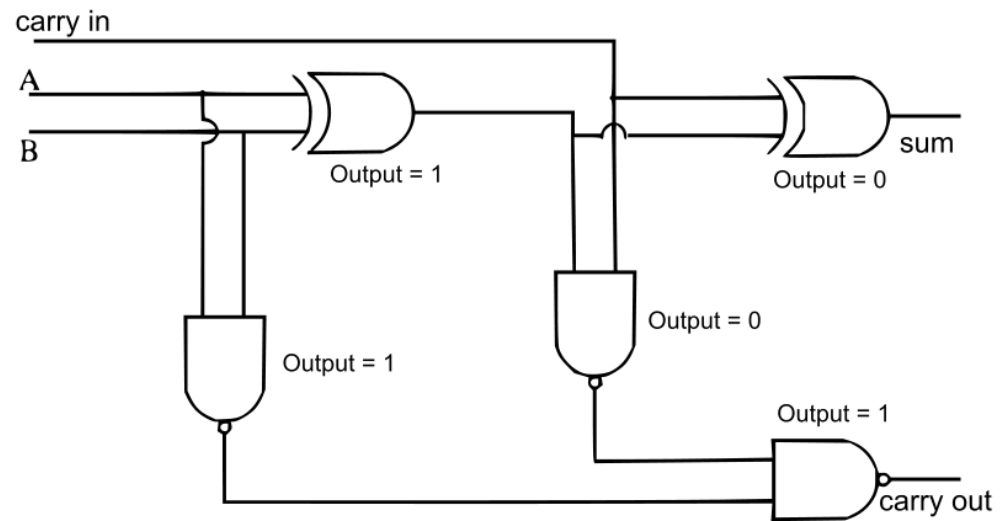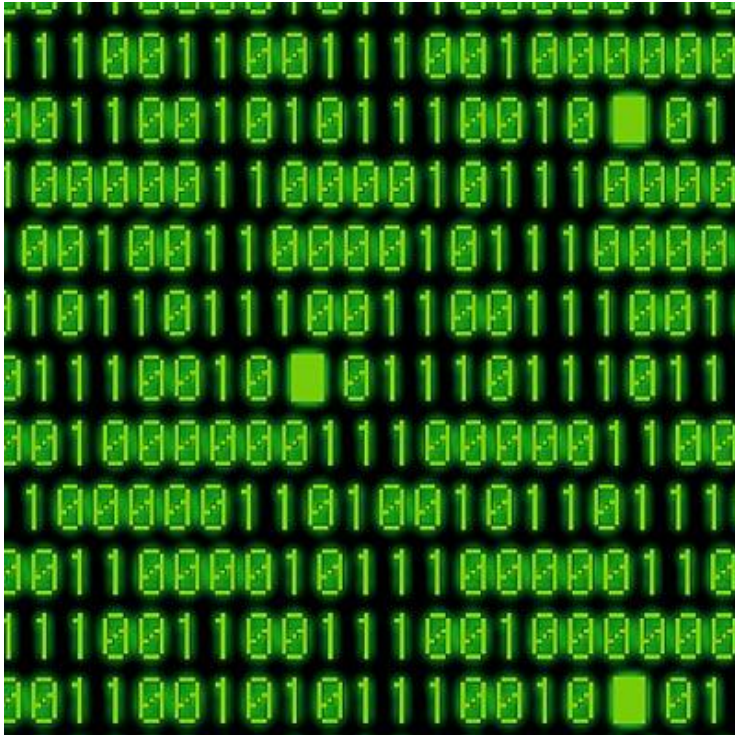http://solar.gmu.edu/teaching/2011_CDS130/

http://blackboard.gmu.edu/

Content

There are only 10 types of people in this world: those who understand binary and those who do not

Content

- **Section I --- Computer fundamentals**
  - Binary Representation of Data, Binary Addition and Subtraction, Data Storage, Logic Circuits and Tables
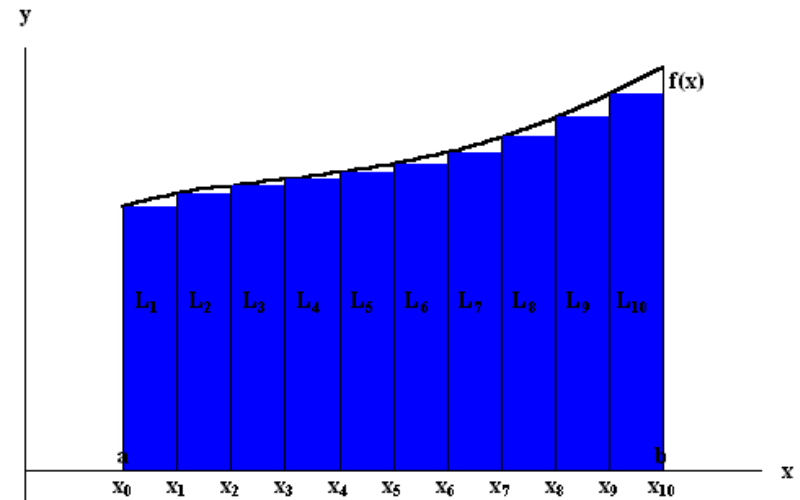
Content

- **Section II --- Scientific Model and Simulation**
  - Mathematical Models, Iteration, Differentiation, Integration, Scientific Method
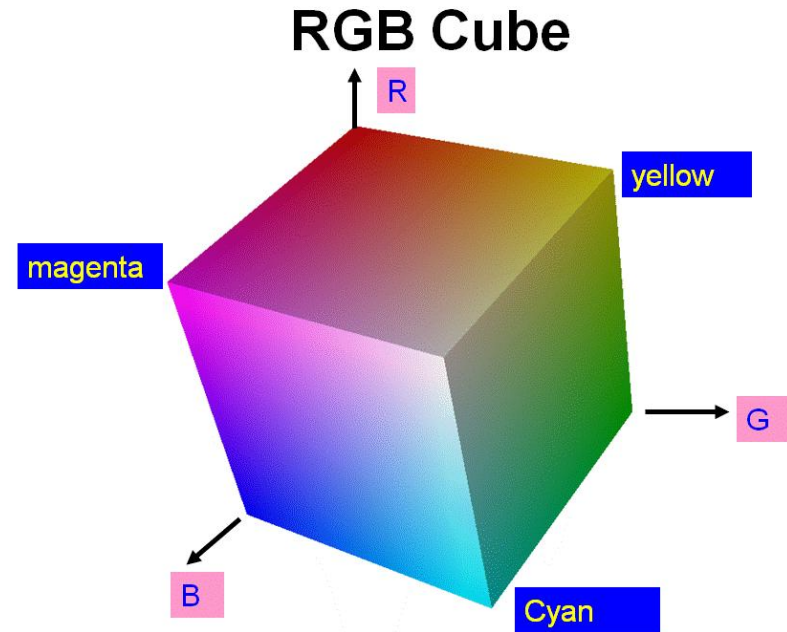

Predator – Prey Model

Integration

Content

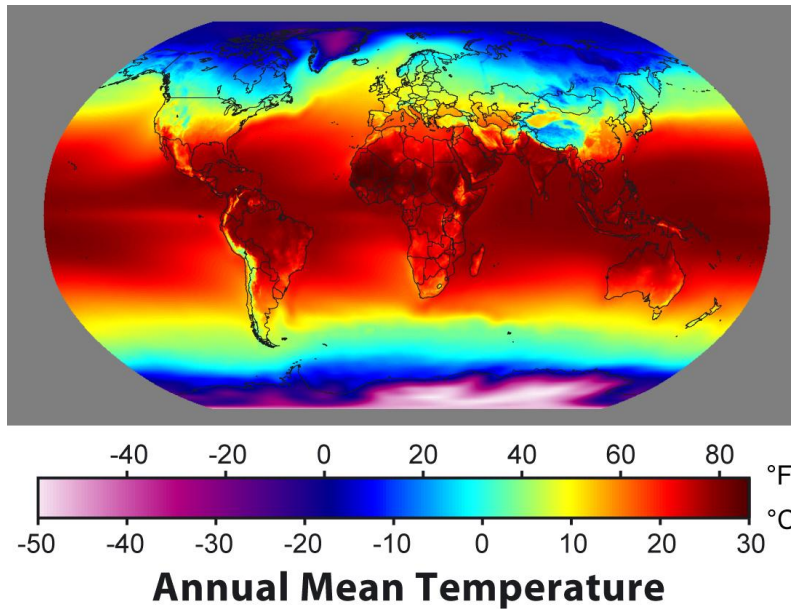- **Section III --- Scientific Visualization**
  - Height plot, 2D array, Image, RGB color system
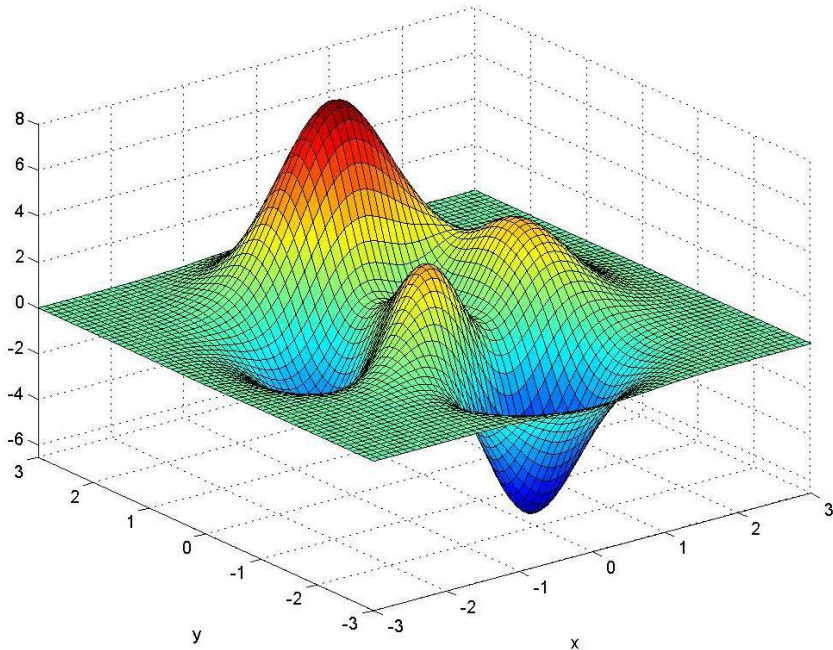
Content

- **Section IV --- Data Analysis**
  - statistical measures, histogram, regression

Annual Mean Temperature
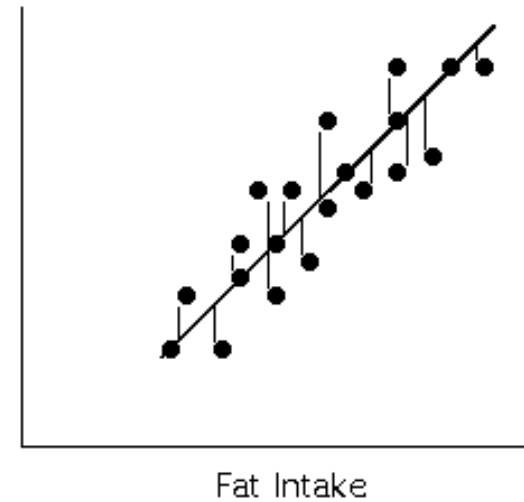
Content

- **Section V --- Computational Ethics**
  - ethical use of publications, data, and code, ethical issues in scientific data and computing
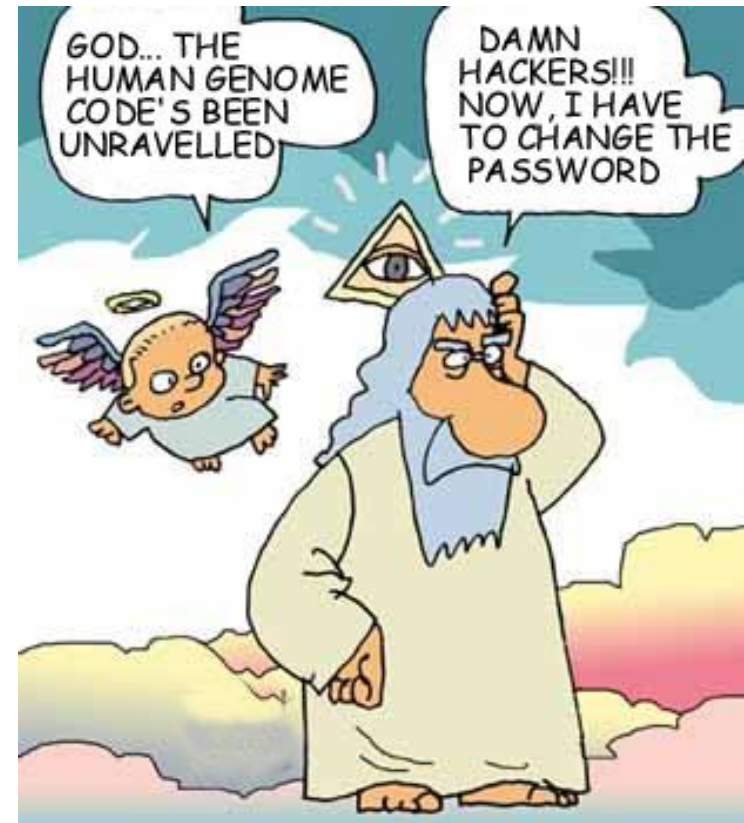
Software Tool -- MATLAB
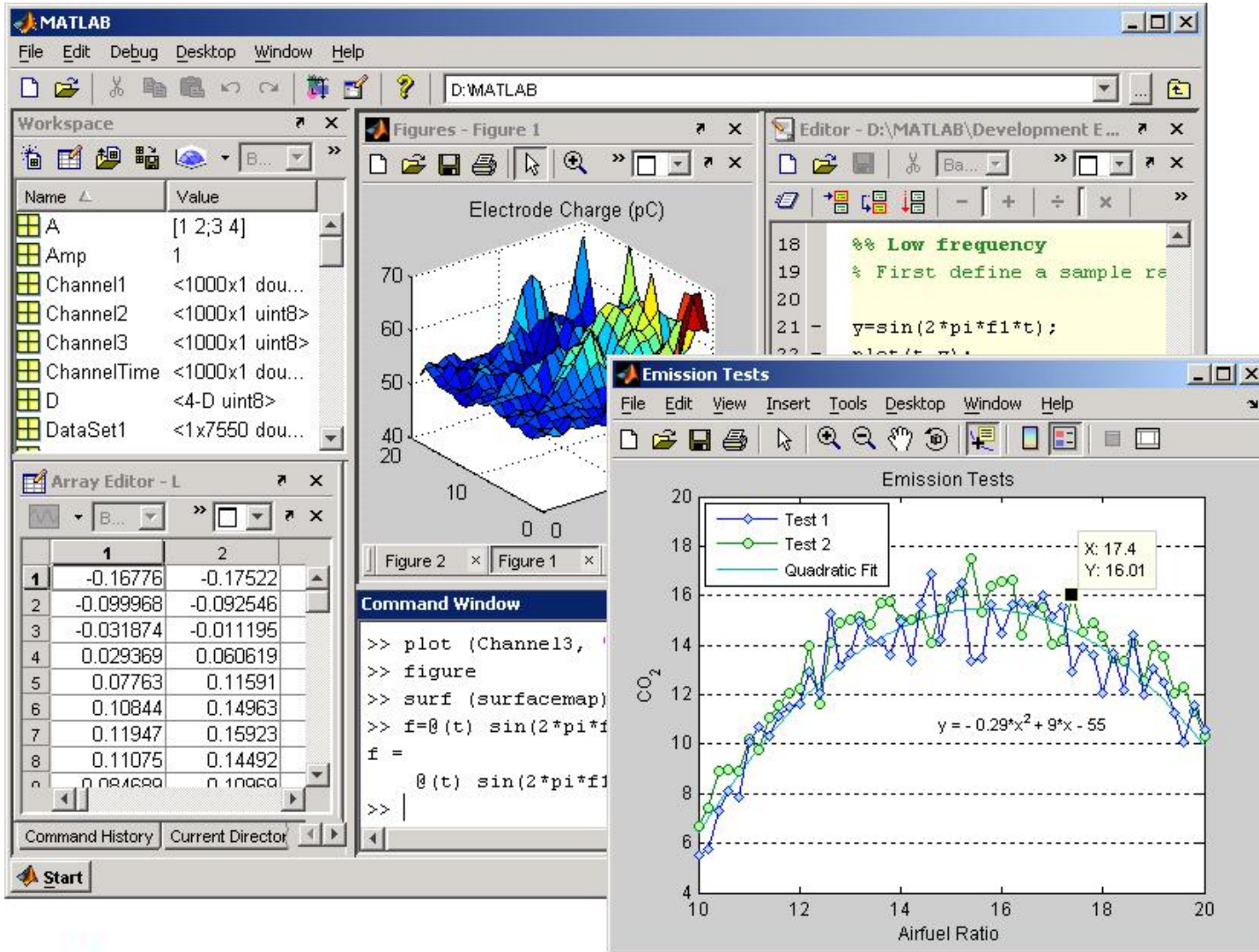
Text Book

- None - no suitable textbook exists for this course.

- Your presence in classes, notes, exercises and discussions

- My Notes, Assignments (homework and project)
  - http://solar.gmu.edu/teaching/2011_CDS130/ClassNotes.html

- Supplementary Online Contents
  - http://solar.gmu.edu/teaching/2011_CDS130/Resources.html

Assignments and Exams

- **Homework**
  - Weekly homework.
  - Homework will consist of multiple choice questions, short answer questions and short projects
  - Only paper copies are acceptable

- **Project**
  - One comprehensive project synthesizing the knowledge you learn and with MATLAB skills

- **Exams**
  - One midterm and one final exam

Grading

- Homework   (30%)
- Project   (15%)
- One mid-term (20%)
- One final   (30%)
- Class Participation (5%)

- Homework with lowest grade will be dropped
- Final grades will be curved

Contact

- **Instructors:** **Prof. Jie Zhang**
- **Contact Info:** jzhang7@gmu.edu (e-mail)
    1-703-993-1998 (office phone)
- **Office Hour:** 1:00 PM to 3:00 PM, Thursday
    or by appointment
- **Office:** Room 351, Research Bldg 1

- **Teaching Assistant: Mr. Puviharan Harendra**
- **Contact info:** pharendr@gmu.edu (e-mail)
- **Office Hour:** by appointment
- **Location:** by appointment

- **Other Tas: Soo Choi; Samantha Fleming; Natalia Lattanzio**

Honor Code

As in any class, you are allowed to study with other students. However, tests and homework assignments must be completed on your own unless stated specifically in the assignment guidelines. In some assignments, you will be directed toward on-line sources for papers, data and code. If these data, code, or papers are used for a project, then you MUST cite where it came from. Specifically, you may not copy any text, computer code, image, data or any other material from the Internet or any other source and represent it as your own. Any material that is taken in whole or in part from any other source (including web-pages) that is not properly cited will be treated as a violation of Mason's academic honor code and will be submitted to the honor committee for adjudication, as will other violations of the honor code.

The End