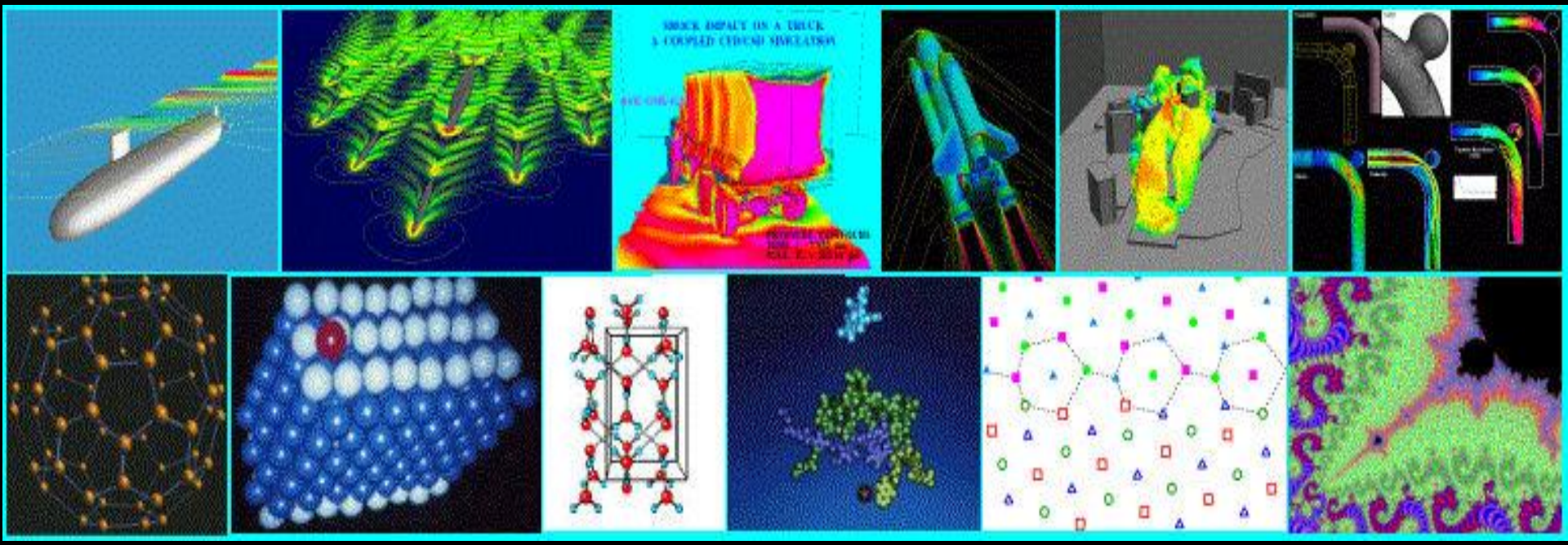
Computing for Scientists

Introduction

(Jan. 22, 2013)

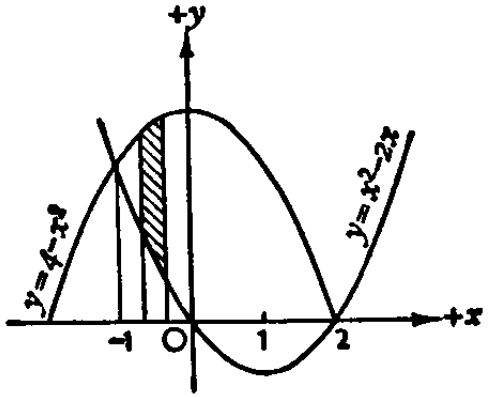


Jie Zhang

CDS 130 - 003
Spring, 2013

Why Computing for Scientists?

Sciences are driven by



Experiment
(~ before 1600)

Math/Theory
(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)

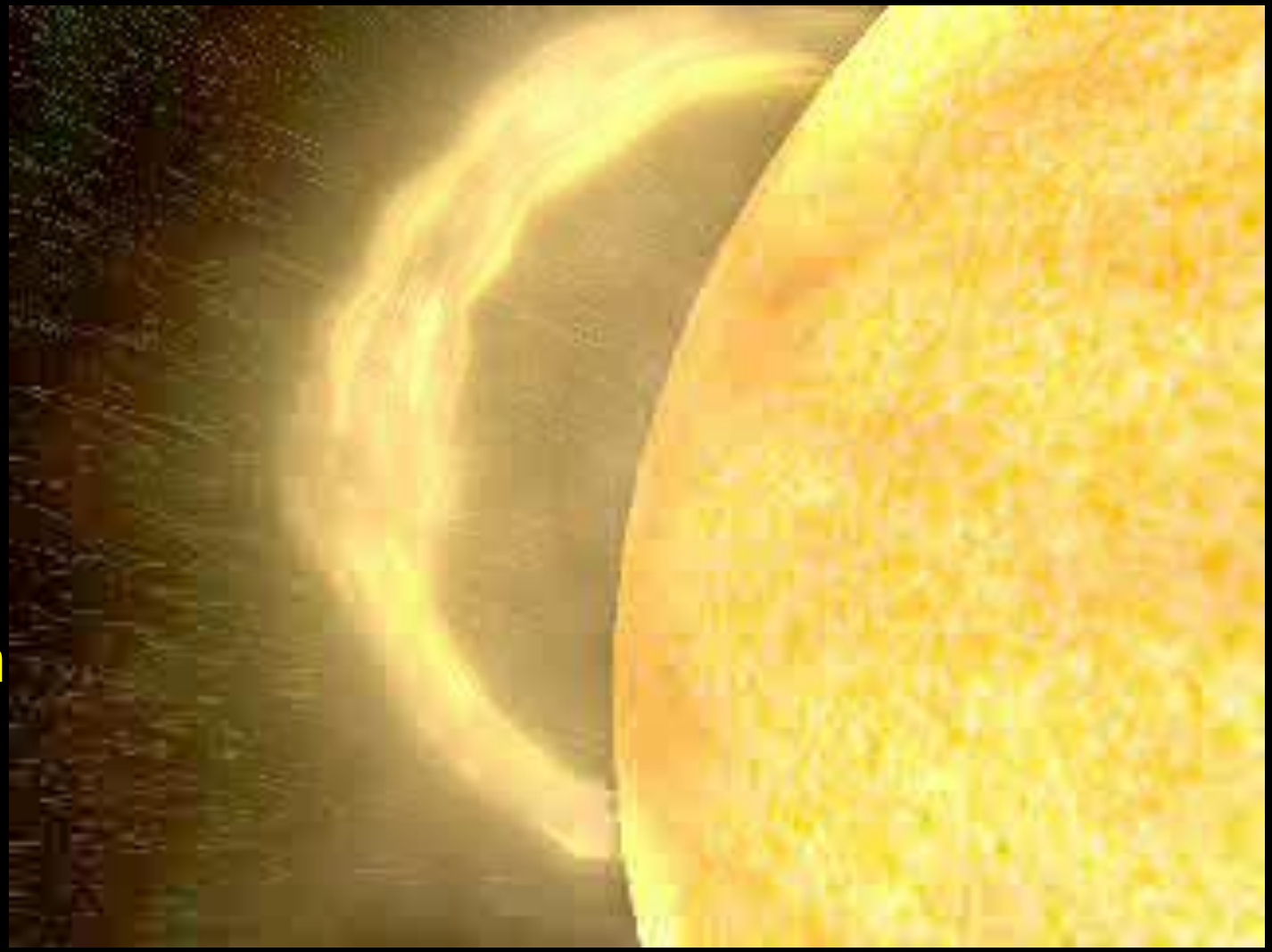
- **"The purpose of computing is insight, not numbers"**
  – Richard Wesley Hamming (1915 – 1998, American Mathematician)

You and Me

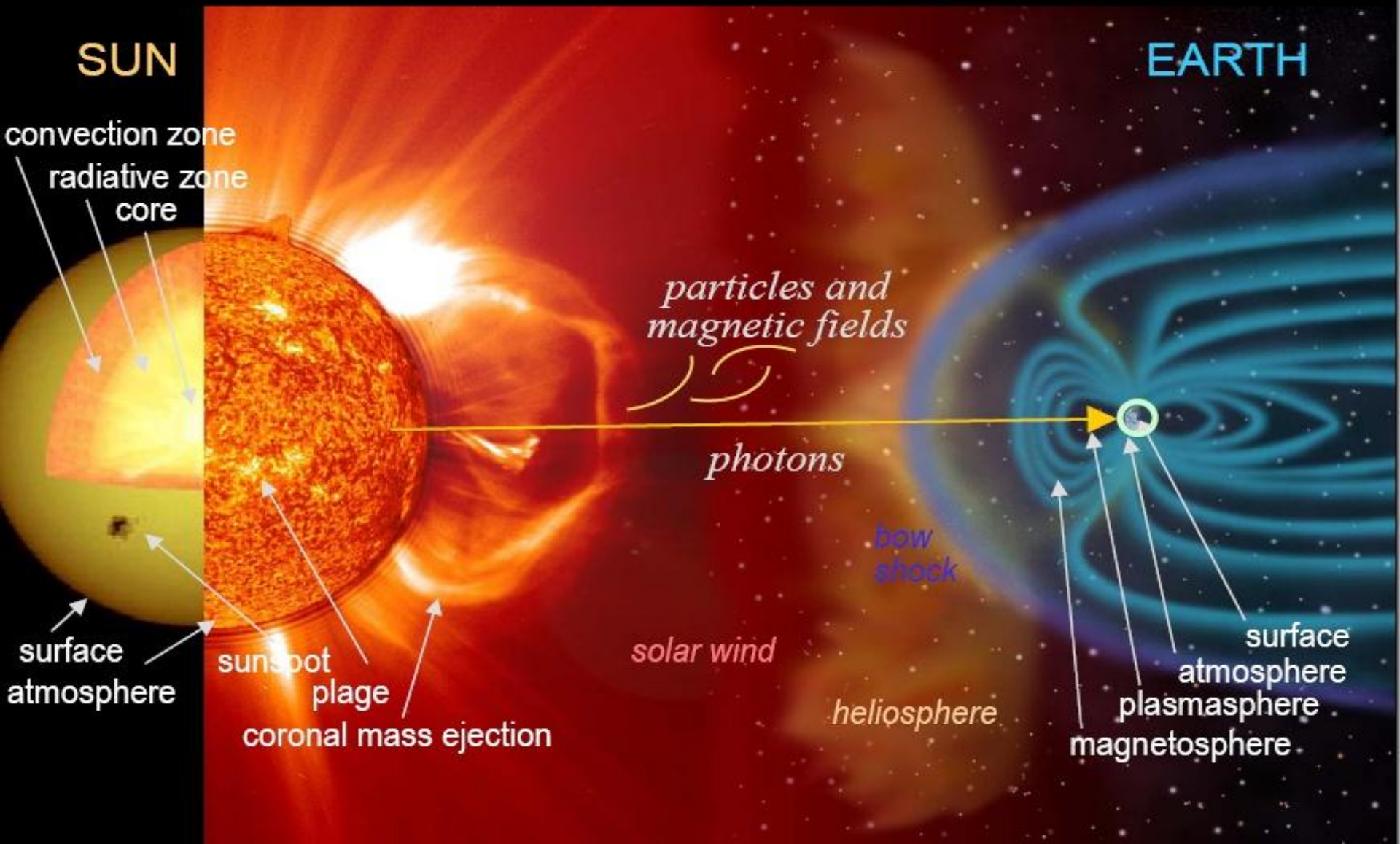
A Space Weather Scientist

It starts from an eruption from the Sun.

Prediction depends on how it propagates



Space Weather: the Systems

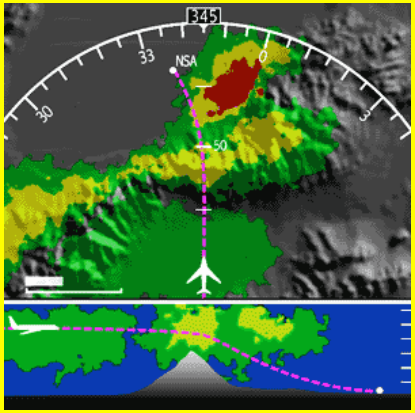


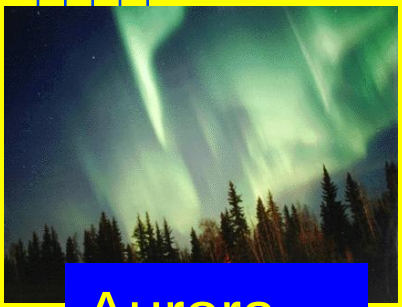
Space Weather: Effects

Human Space Exploration

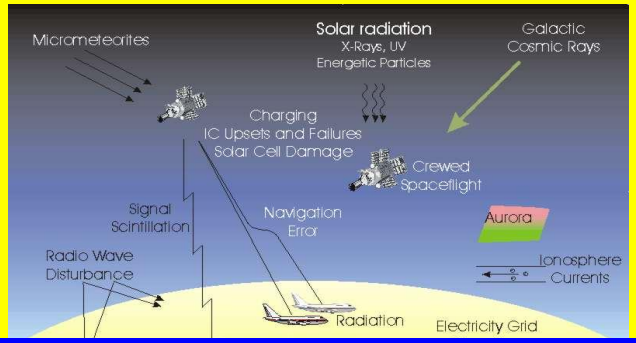
Satellite Operation

Aviation



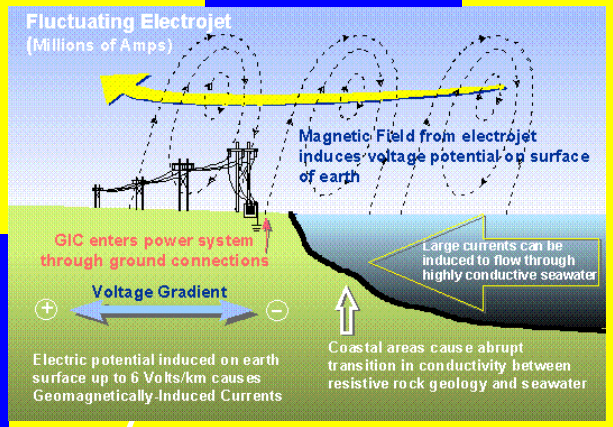


Aurora



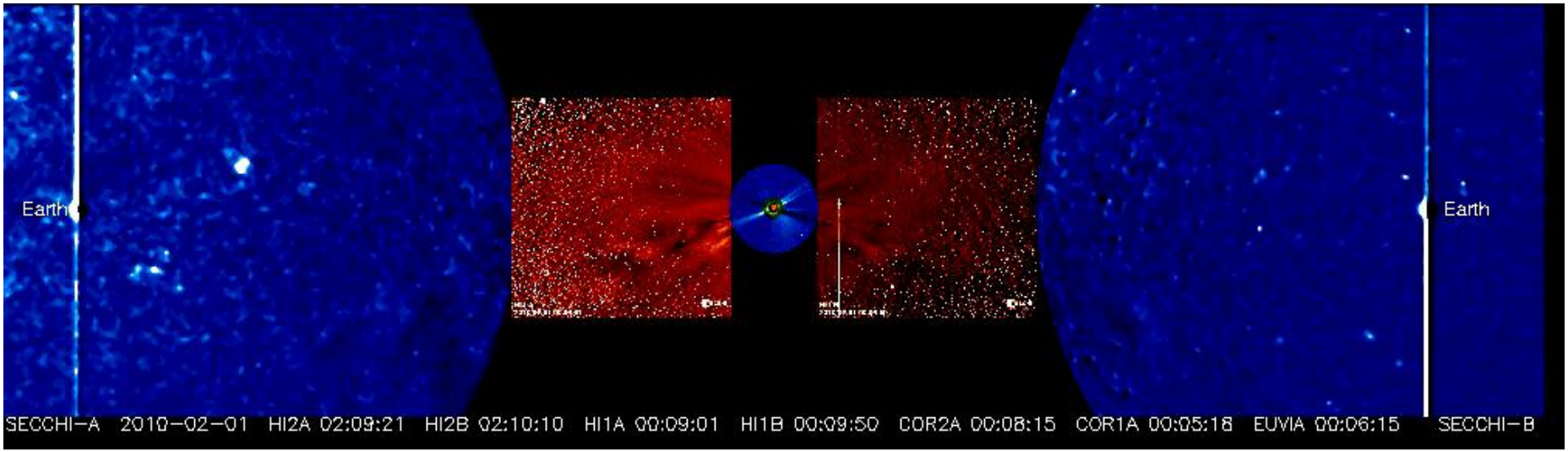
Communication and Navigation

Power



SDO Mission

STEREO Mission



Syllabus

http://spaceweather.gmu.edu/jzhang/teaching/2011_CDS130_Spring/

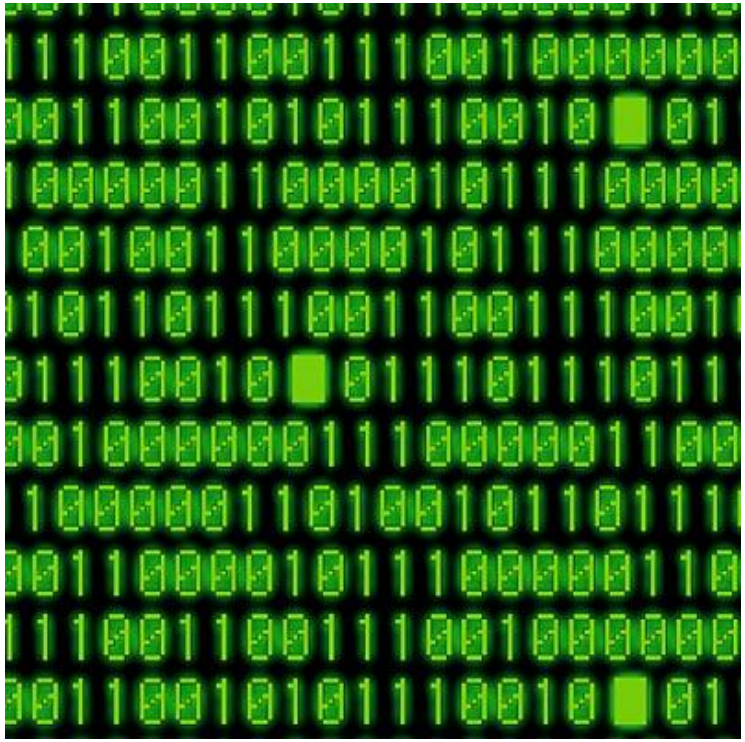
https://mymasonportal.gmu.edu/

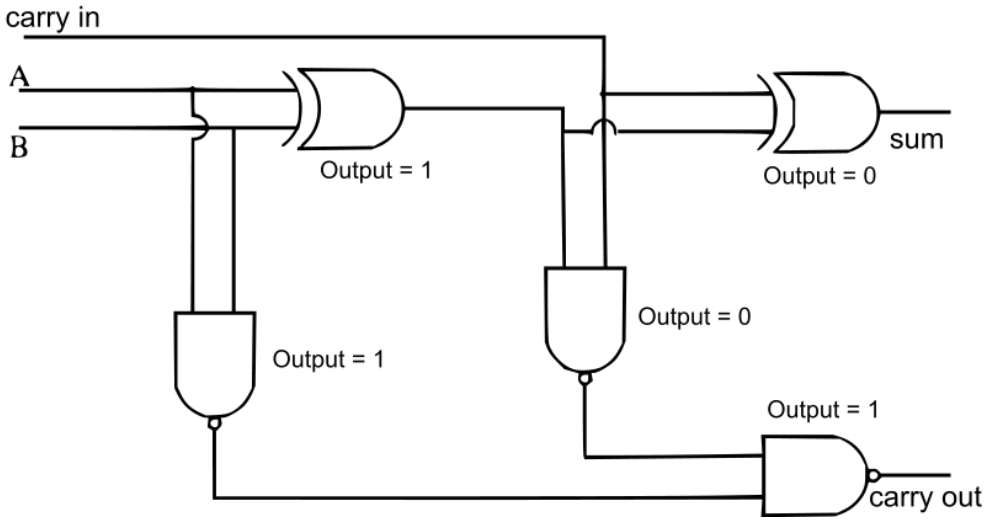
Content

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

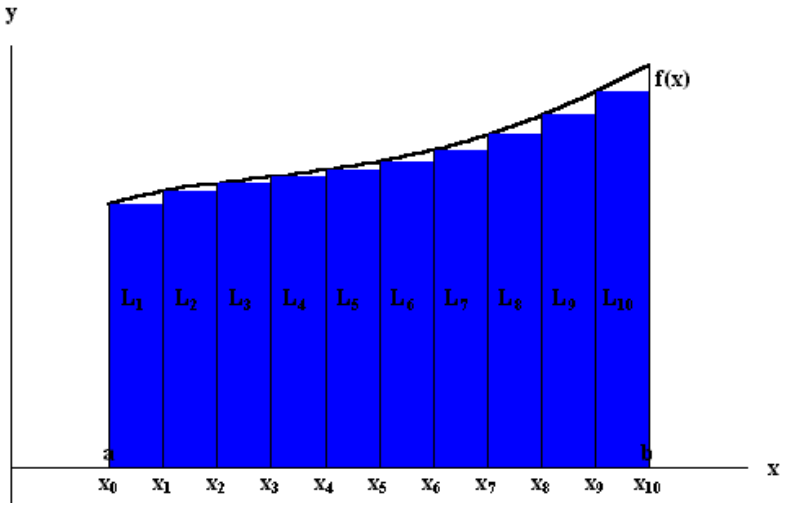




Content

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

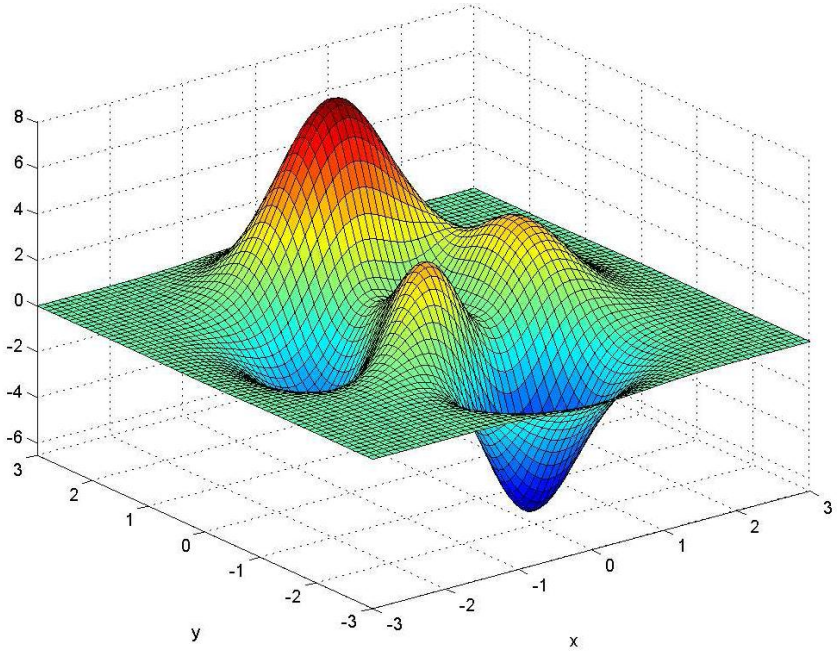
Predator – Prey Model

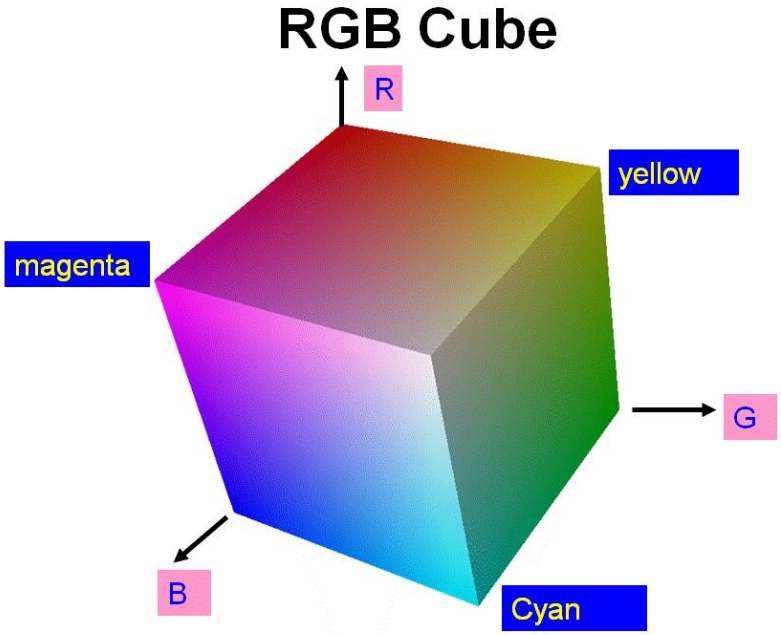


Integration

Content

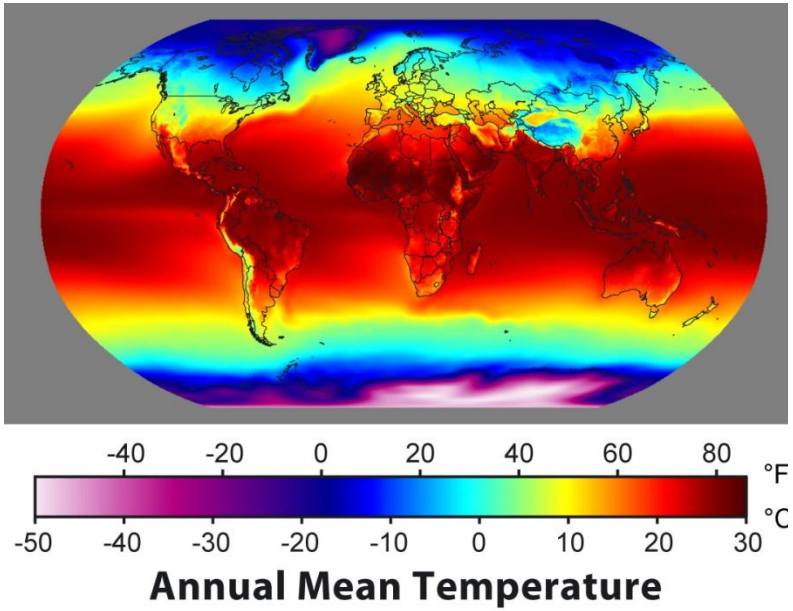
- **Section III --- Scientific Visualization**
  - Height plot, 2D array, Image, RGB color system

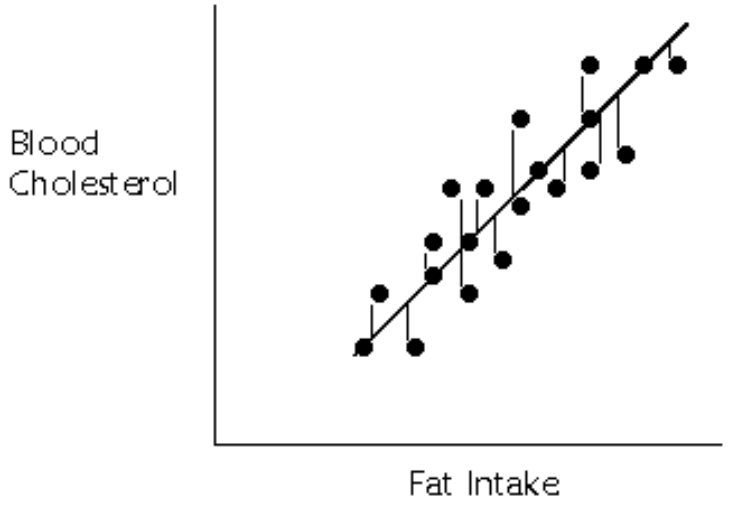




Content

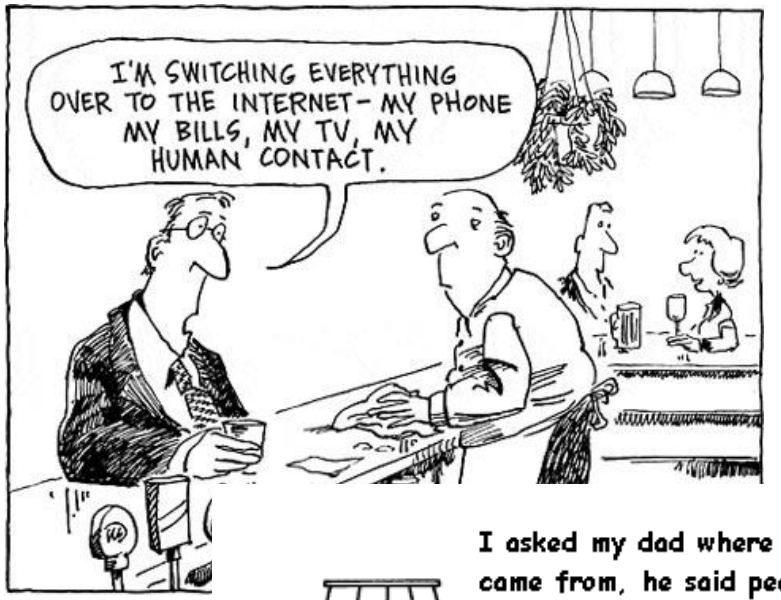
- **Section IV --- Data Analysis**
  - statistical measures, histogram, regression

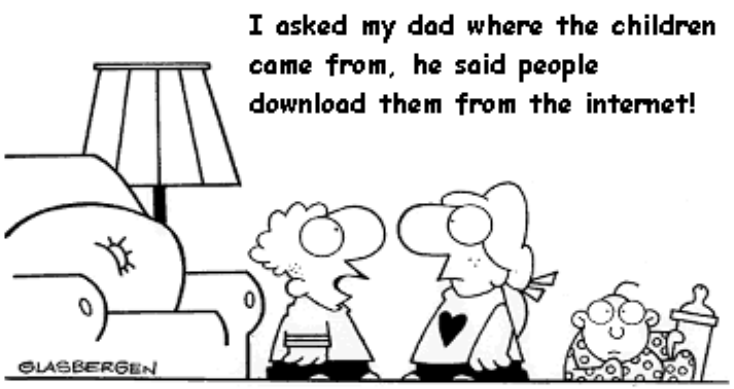


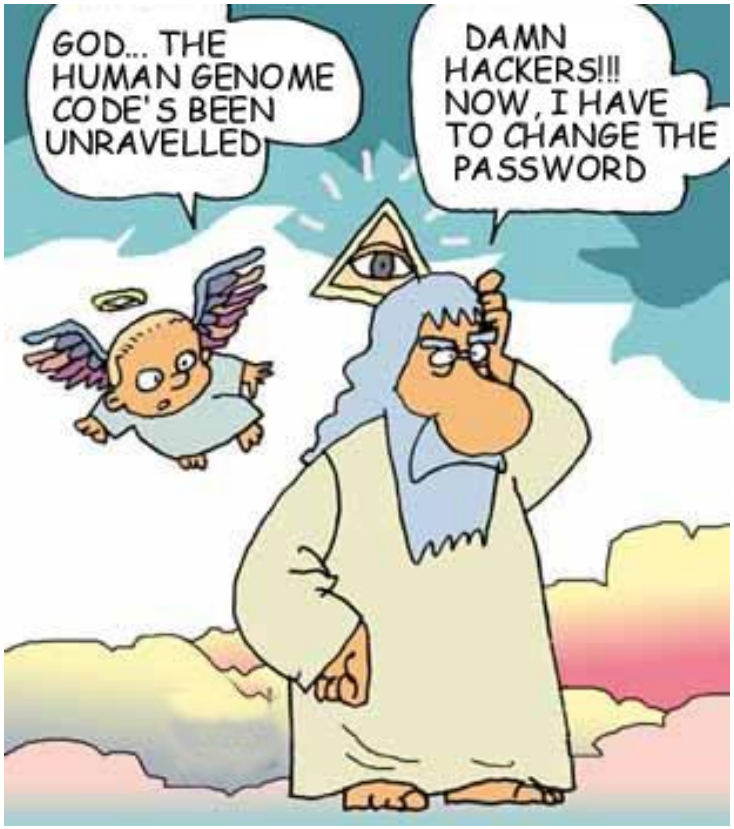


Content

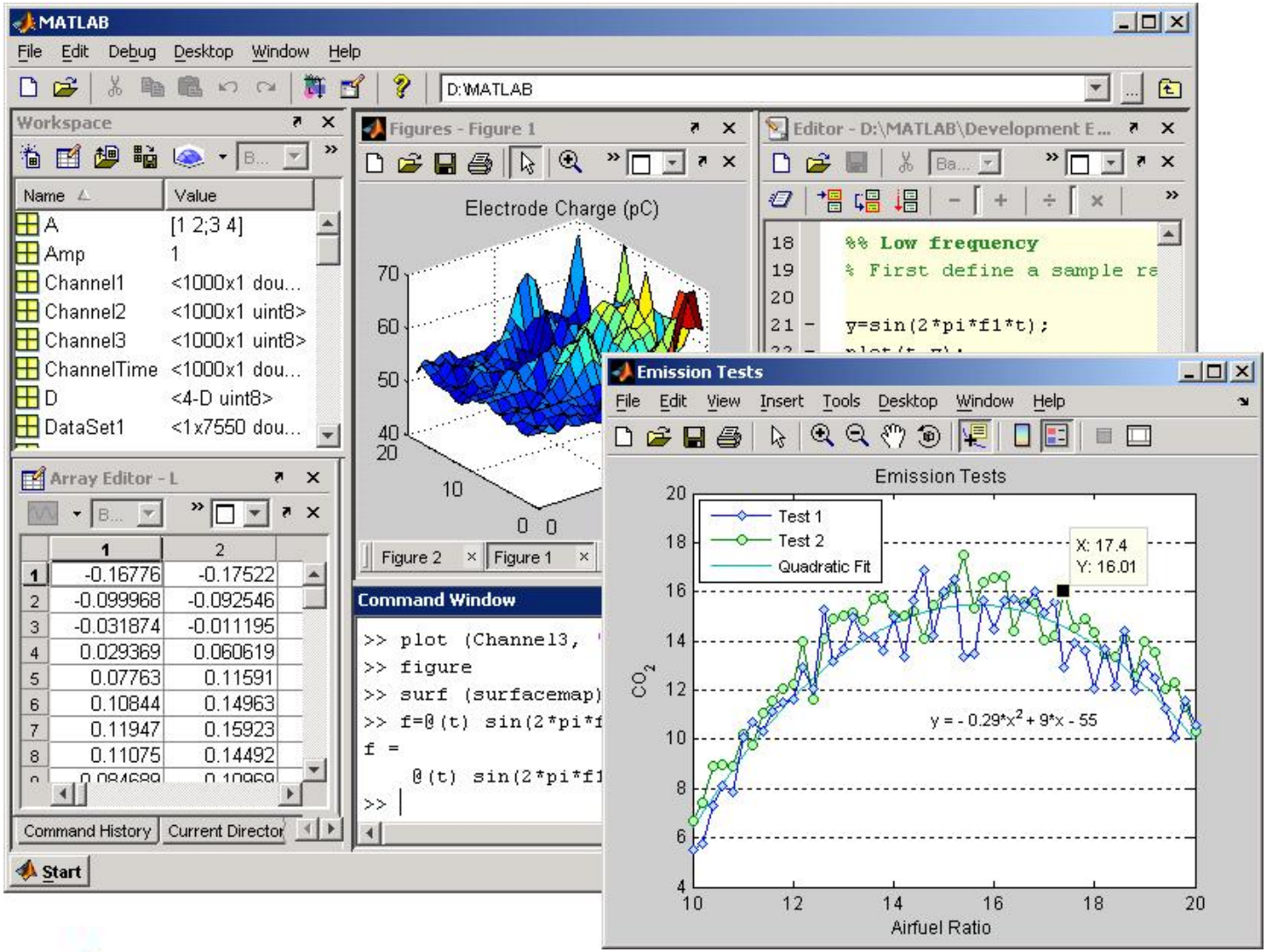
- **Section V --- Computational Ethics**
  - ethical use of publications, data, and code, ethical issues in scientific data and computing







Software Tool -- MATLAB



MathWorks

Text Book

- None - no suitable textbook exists for this course.
- Your presence in classes, notes, exercises and discussions
- My Notes, Assignments (homework and projects)
  - http://spaceweather.gmu.edu/jzhang/teaching/2011_CDS130_Spring/class_notes.html
- Supplementary Online Contents
  - http://spaceweather.gmu.edu/jzhang/teaching/2013_CDS130_Spring/resource.html

Assignments and Exams

- **Homework**
  - Weekly homework.
  - Homework will consist of multiple choice questions and short answer questions
  - Only paper copies are acceptable, unless otherwise specified.
  -
- **Project**
  - One comprehensive project synthesizing the knowledge you learn and with MATLAB skills
- **Exams**
  - One midterm and one final exam (closed book)

Grading

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

- Homework with the 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:** 3:00 PM to 5:00 PM, Tuesday
  or by appointment
- **Office:** Room 351, Research Hall

- **Teaching Assistants:**
  - **Ms. Angeline Chau (**achau2@masonlive.gmu.edu**)**
  - **Ms. Jessica Mitchum**(jmitchum@masonlive.gmu.edu)
- **Office Hour:** by appointment
- **Location:** by appointment

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