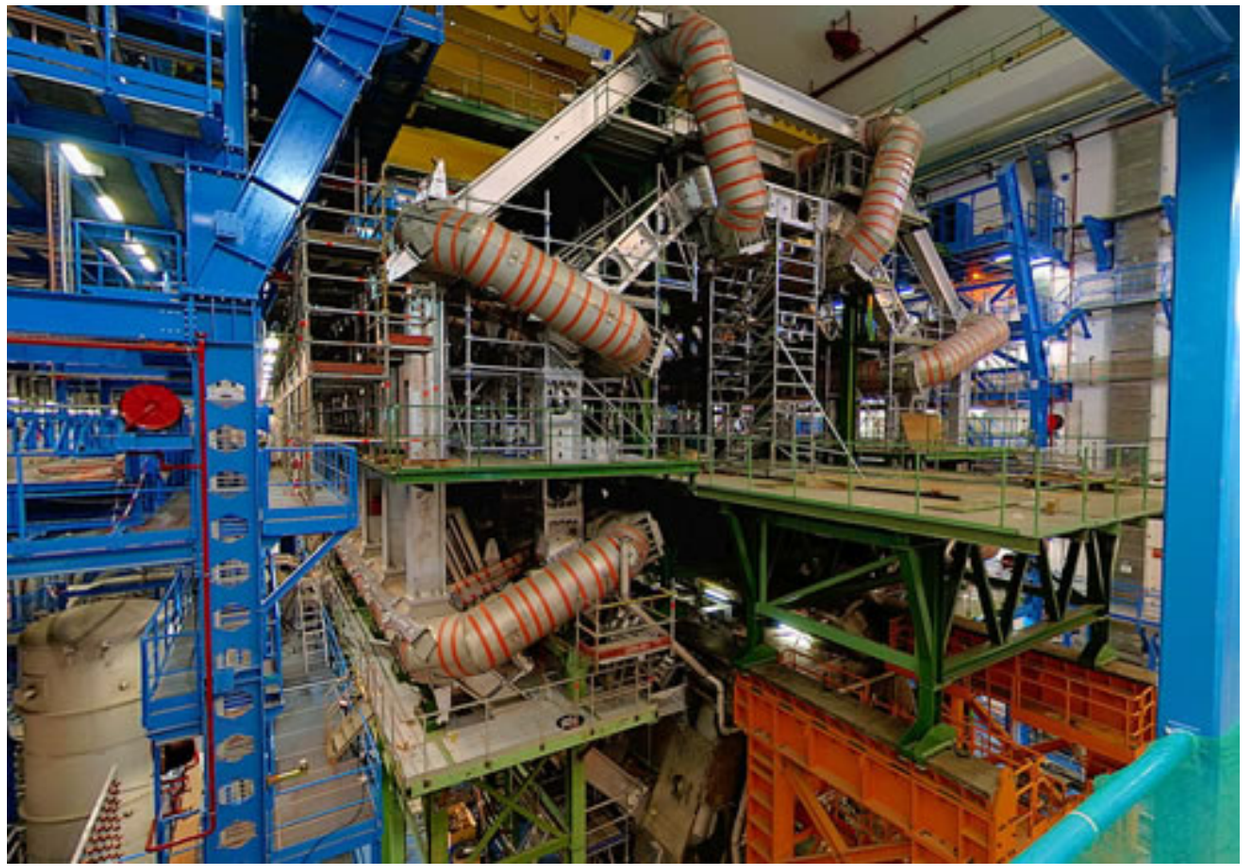
High Performance Scientific computing

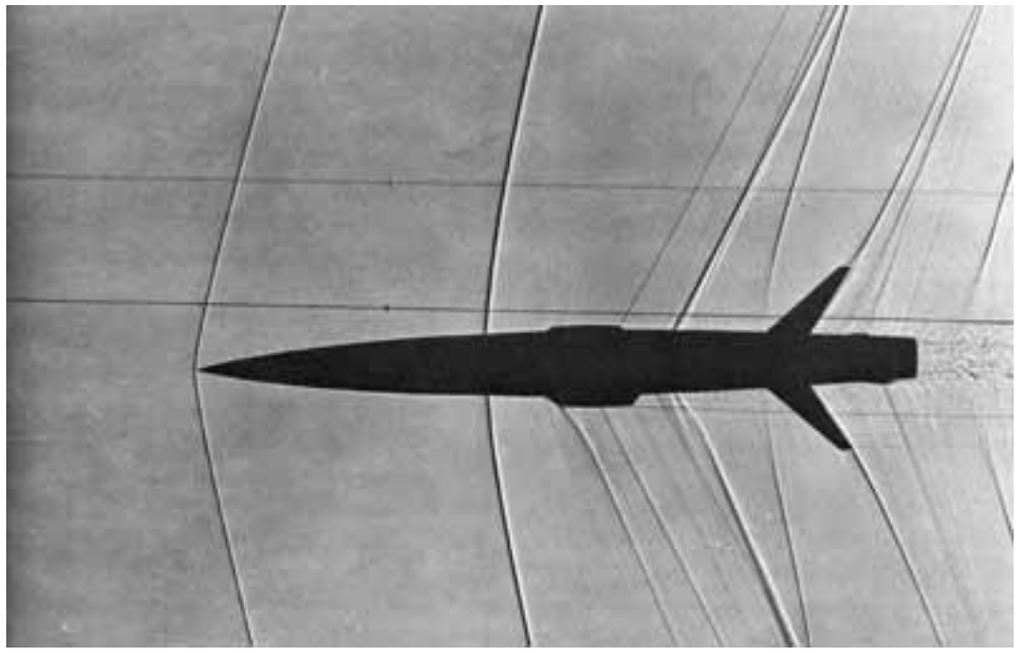
Lecture 1

S. Gopalakrishnan

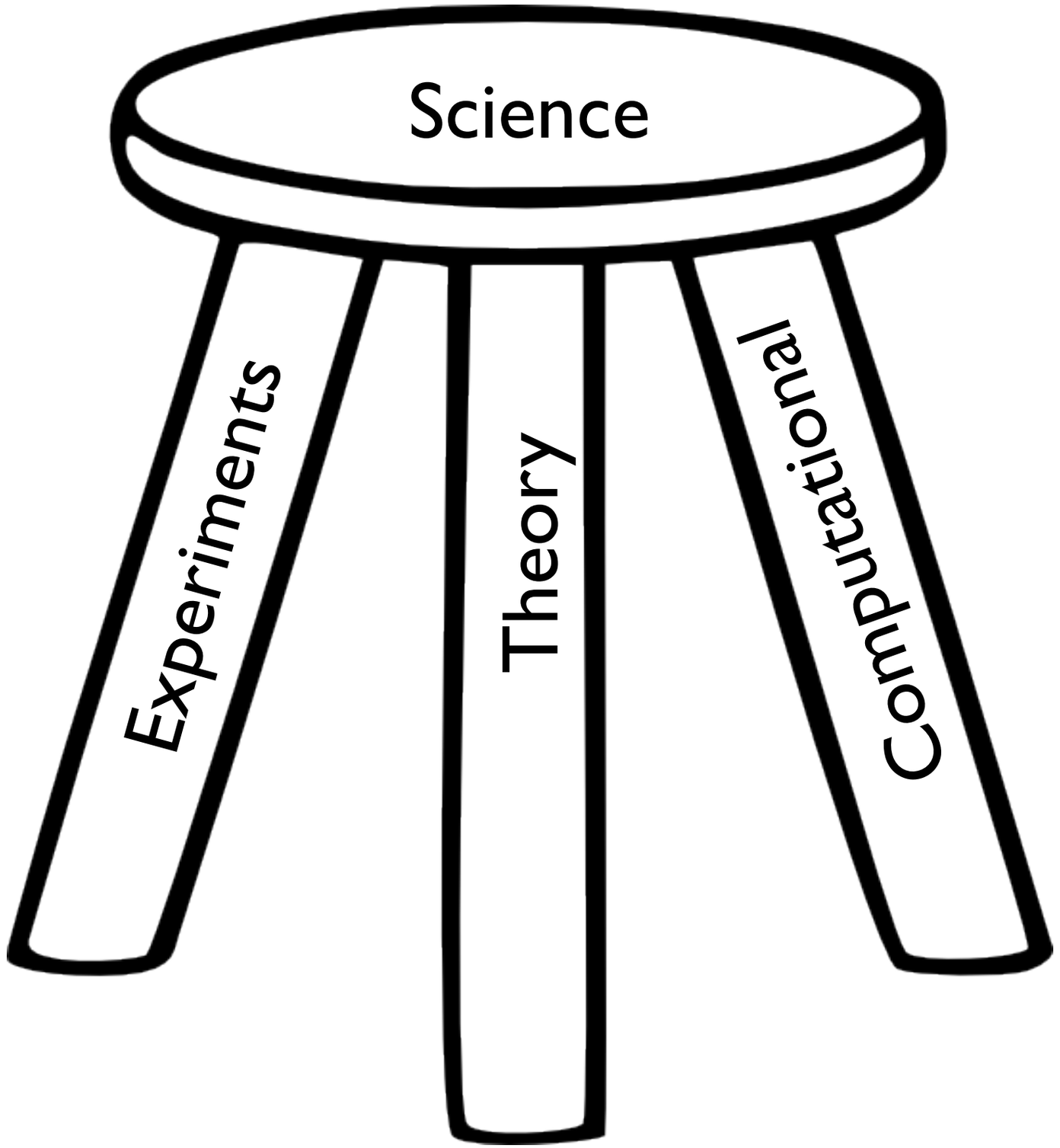
Theory

Experiments

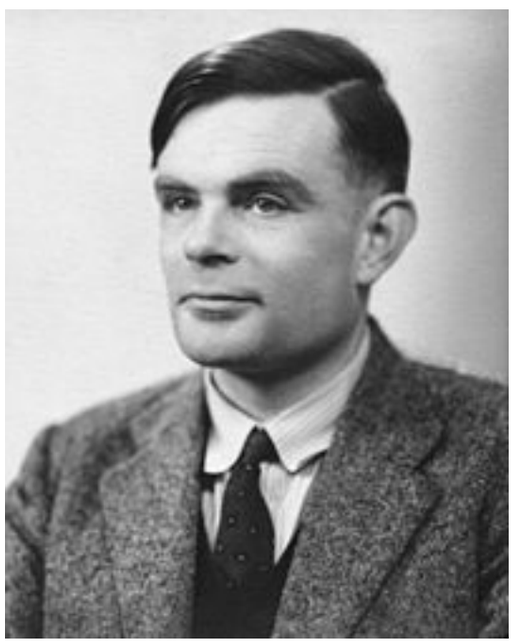




Album of Fluid Motion


Science
Experiments
Theory
Computational

Computations



Difference Engine

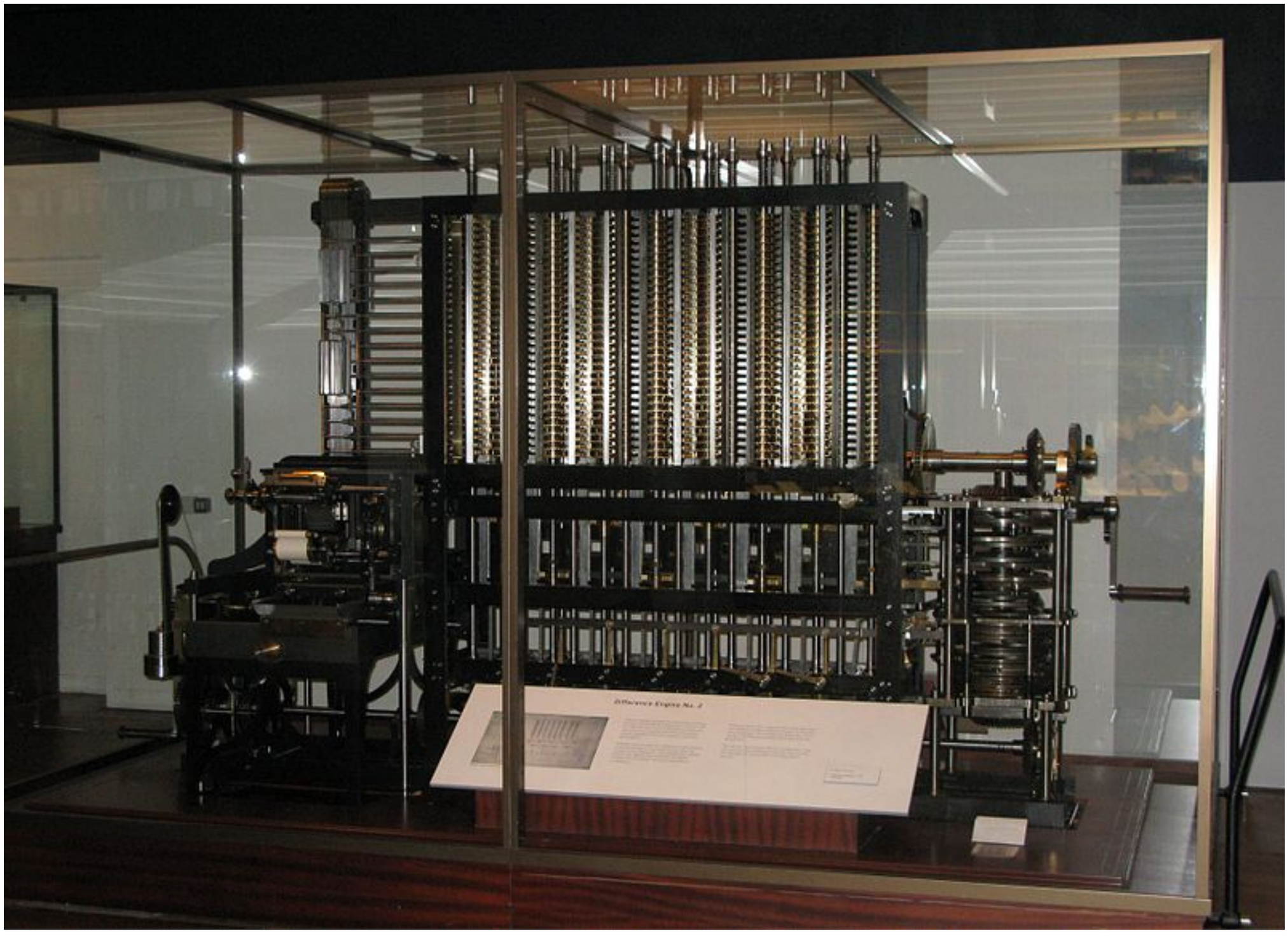


Image: ©Wikipedia

ENIAC

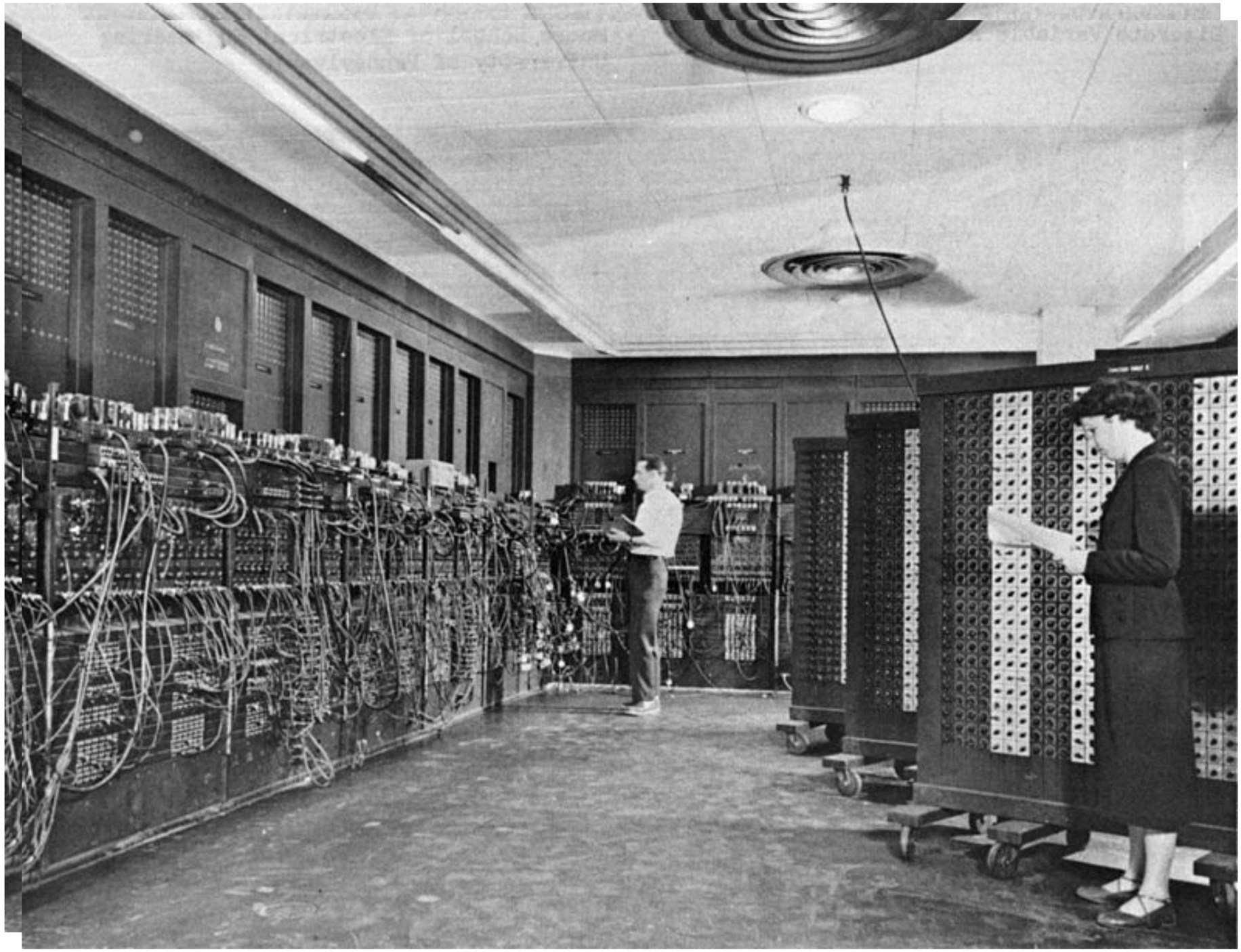


Image: ©Wikipedia

Growth in computing power

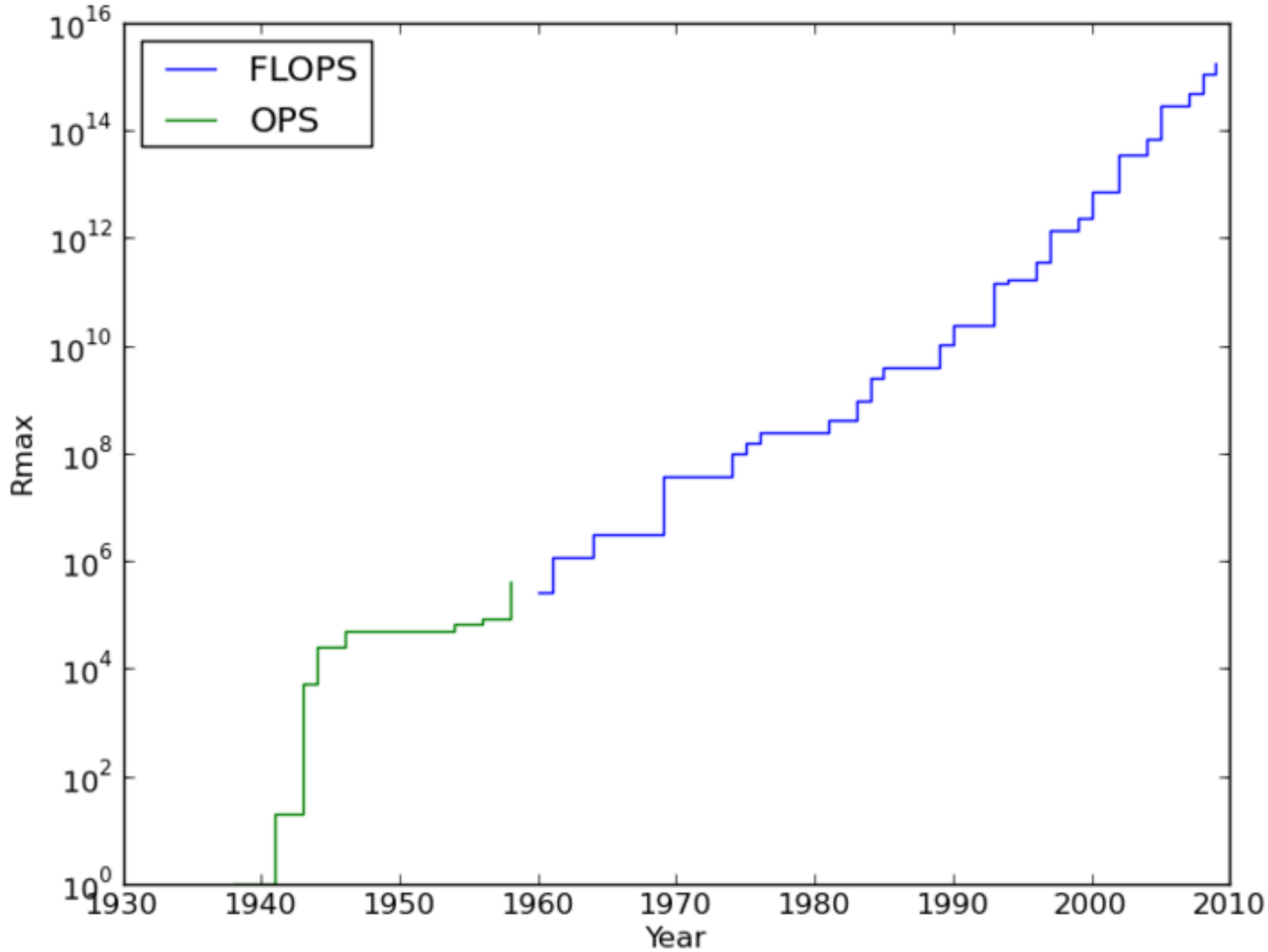


Image: ©Wikipedia

Growth in computing power

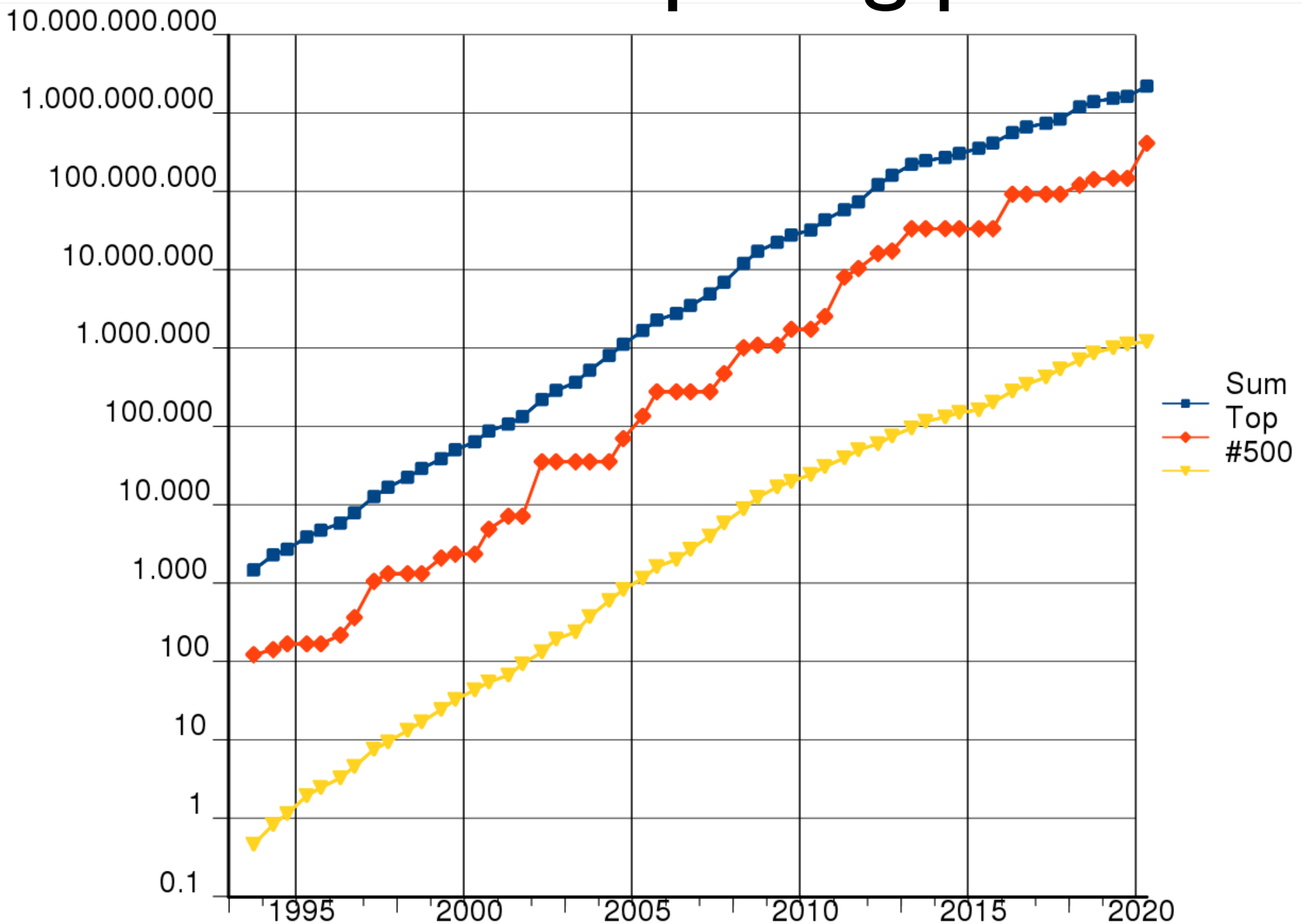


Image: ©top500.org

Fugaku - World's fastest SC

Located at RIKEN Centre for Computational Science, Kobe
Peak FLOPs - 537 PetaFlops (Peak)
Power Consumed - 30 MW
Memory - 5 PB
Cores - 7,630,848 - A64FX 48C 2.2 Ghz (ARM based)

Image: ©Wikipedia

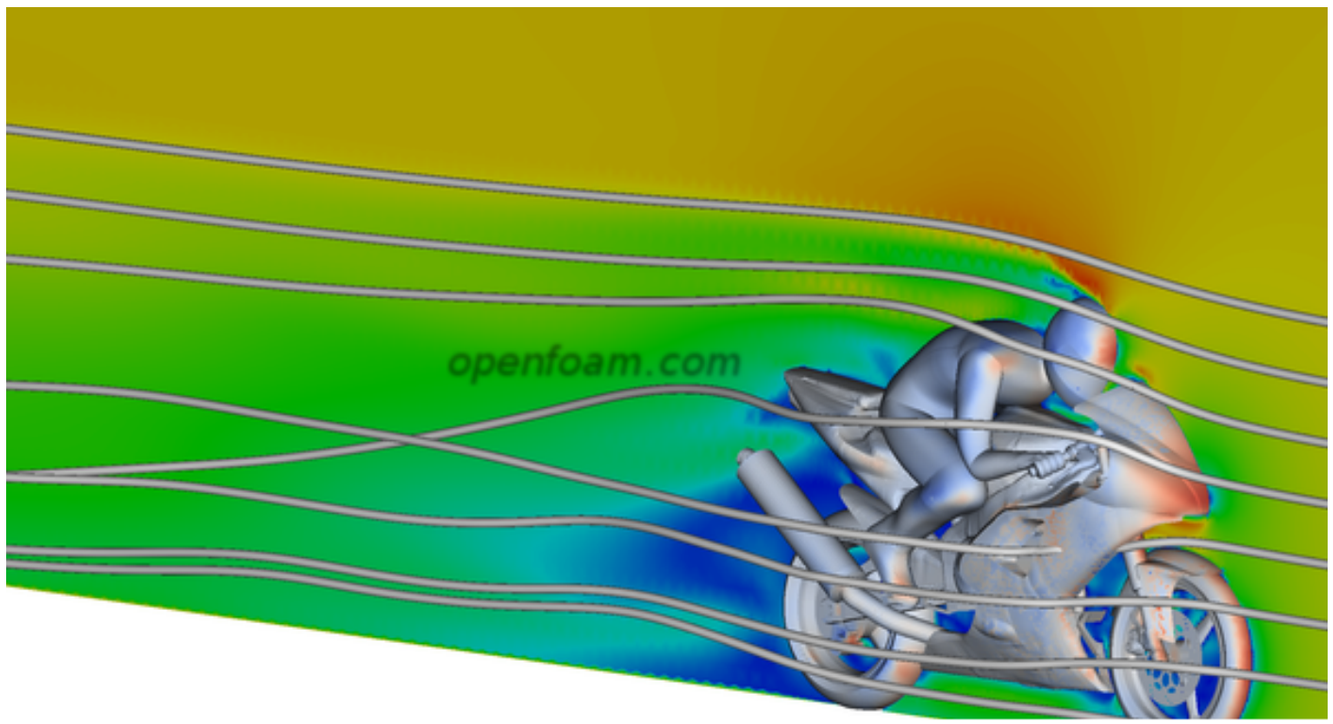
Spacetime2 - IIT Bombay

Located at Old CSE Building
Peak FLOPs - 1 PetaFlop (Peak)
Power Consumed - 0.2 MW
Memory - 43.75 TB
Cores - 9792 - Intel (Skylake + Broadwell), 64 P100 GPUS

Image: ©Wikipedia

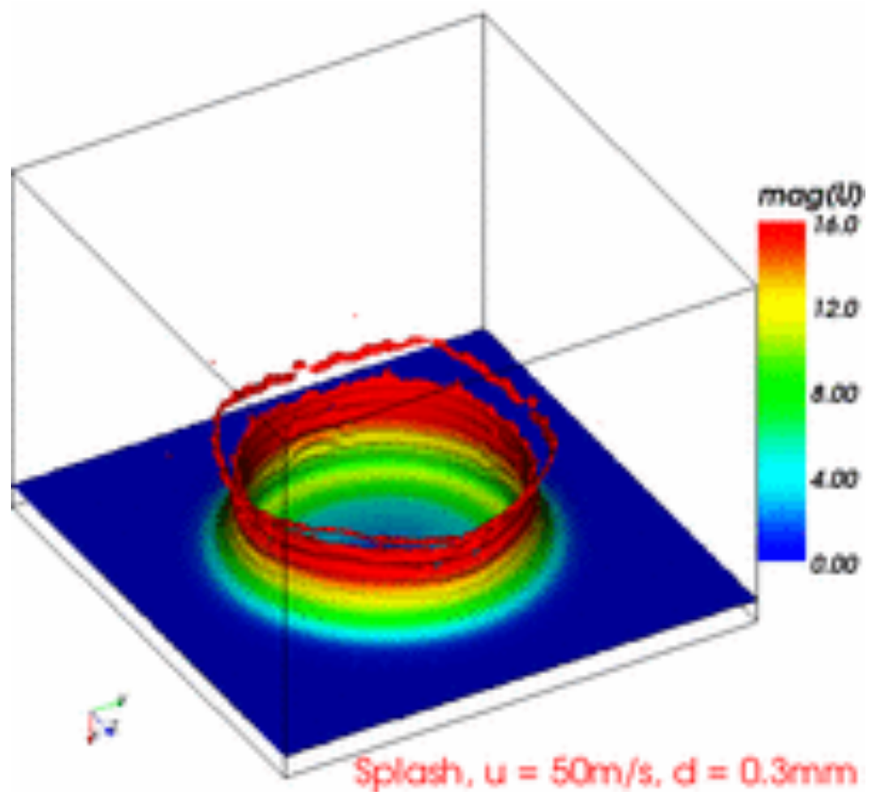
Application areas

Computational Fluid Dynamics



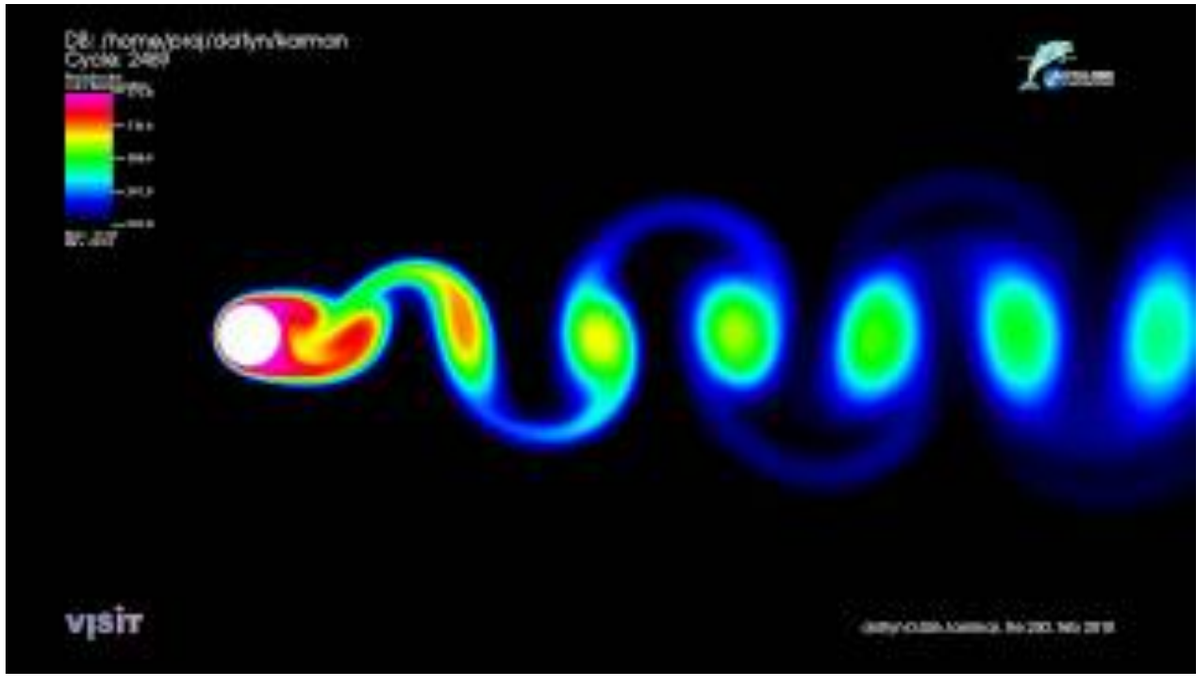
Exterior Aerodynamics

Image: ©openFoam.com



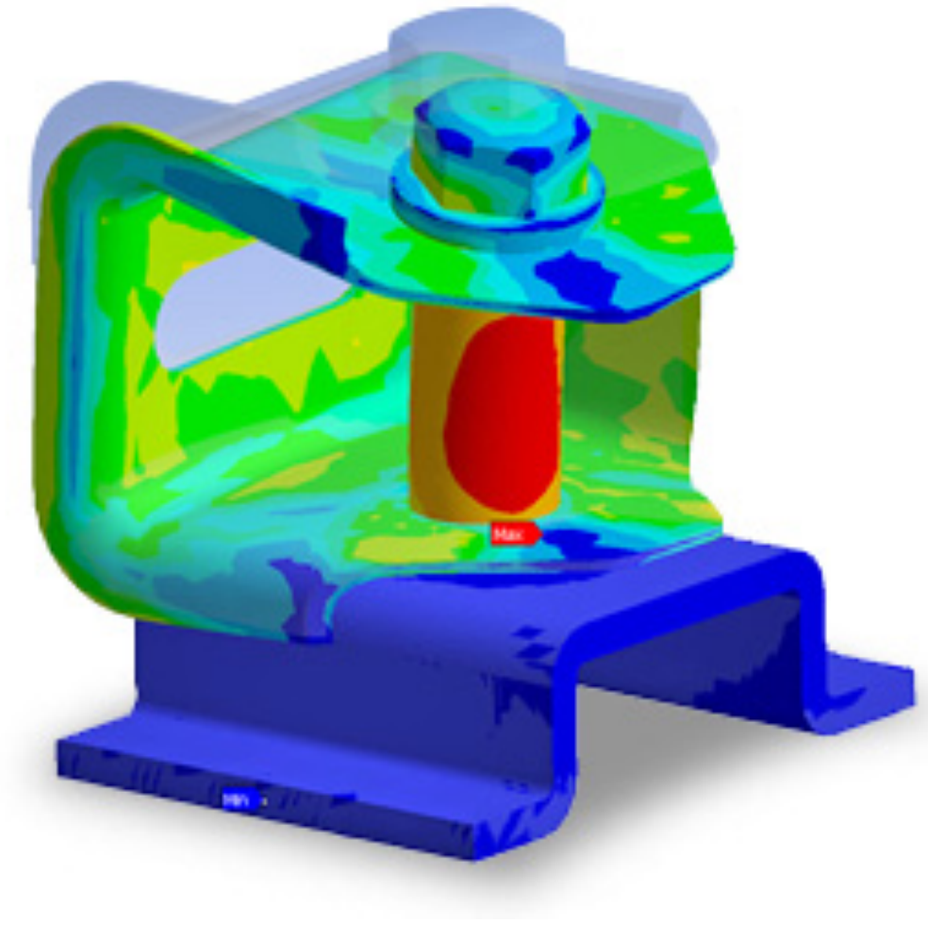
Droplet splash impact

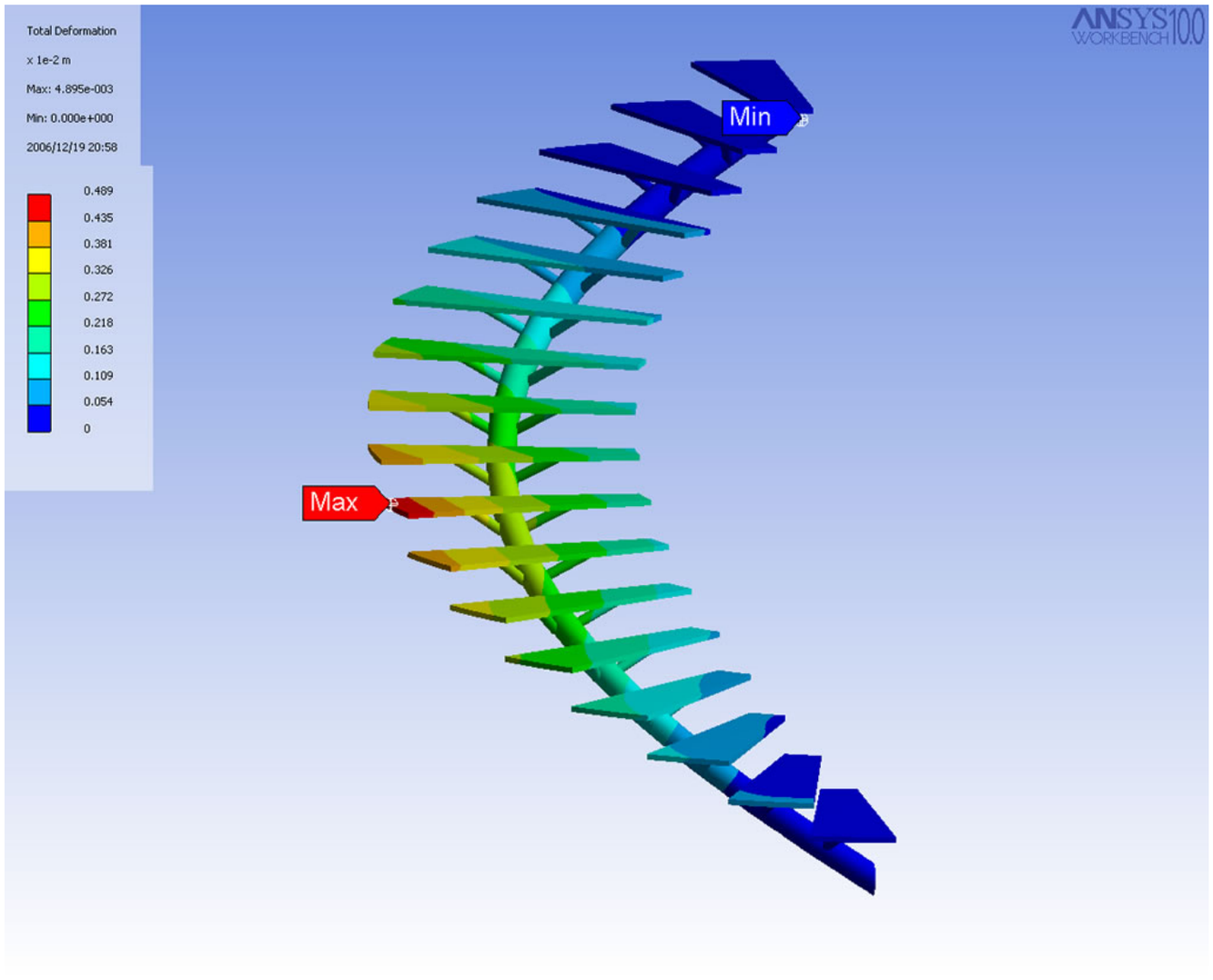
Image: © foamcfd.com



Vortex Shedding

Structural Mechanics

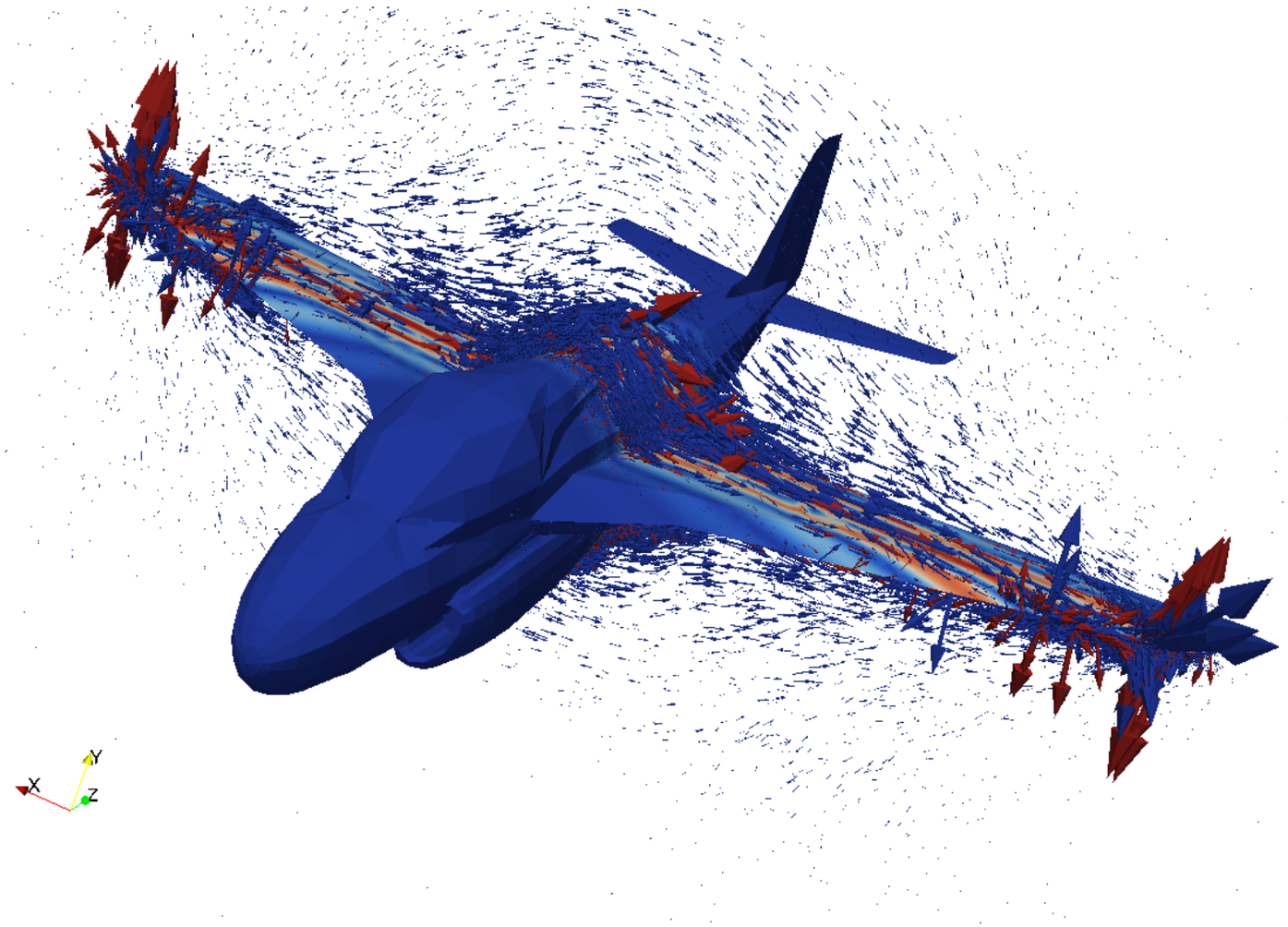




Stress Analysis

Image: © ansys.com

Computational Electromagnetics



Scattering of Electromagnetic waves

Image: Nodal Discontinuous Galerkin Methods on Graphics Processors
A. Kloeckner, T. Warburton, J. Bridge, J. S. Hesthaven

Computational Astrophysics

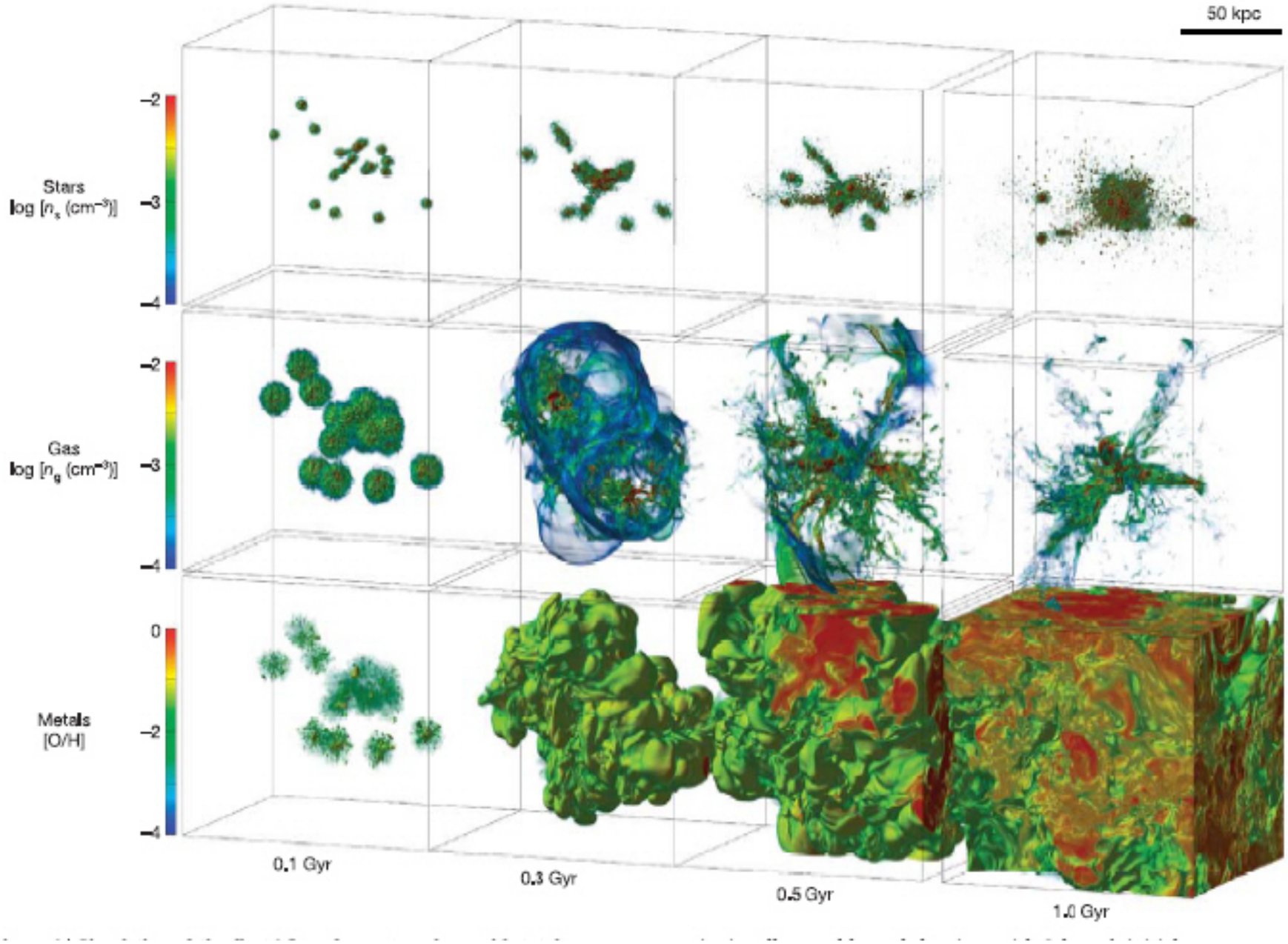
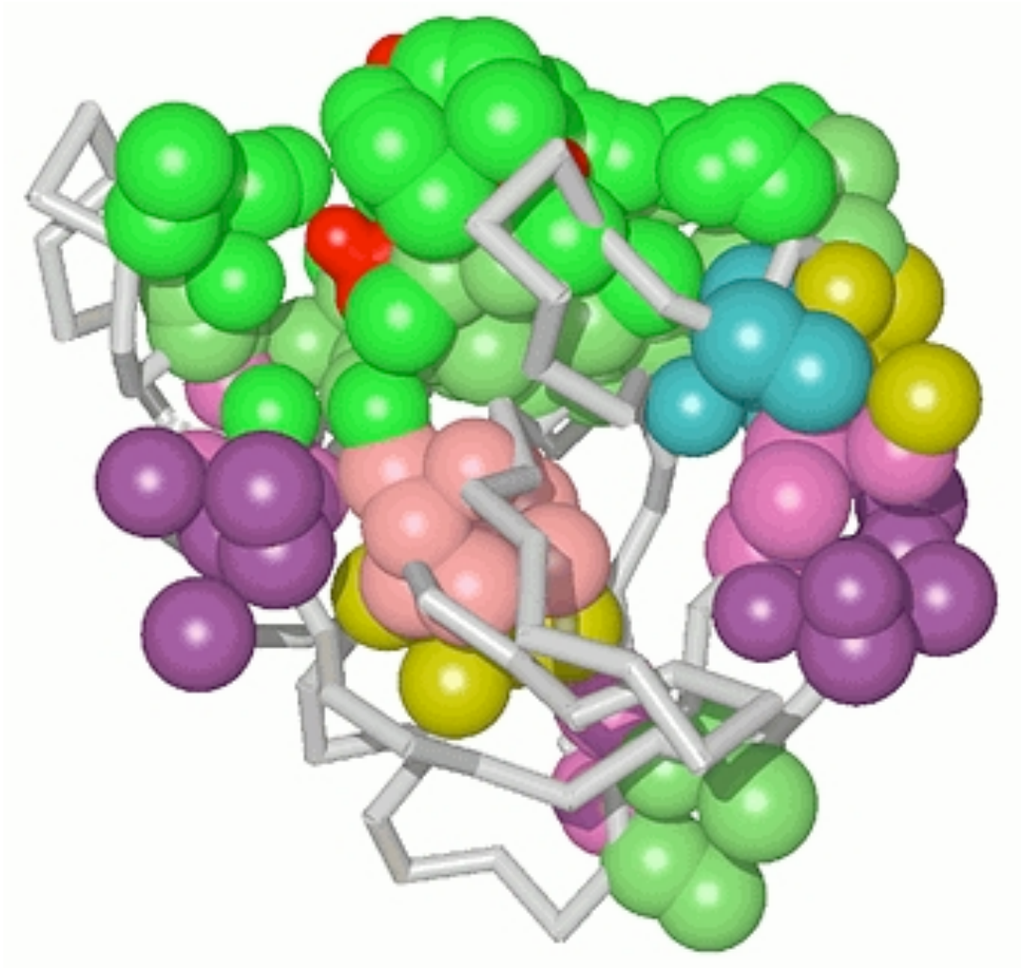
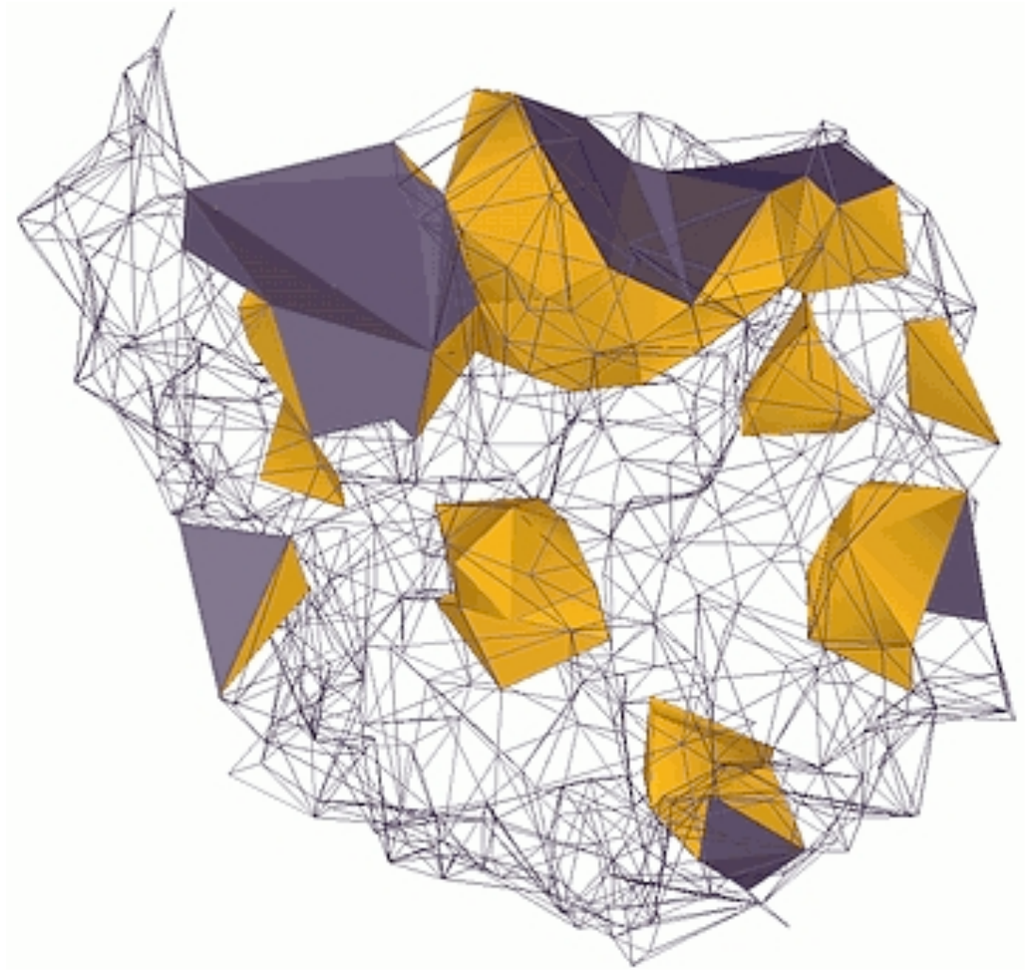


Image: physicsworld.com

Computational Biology





http://sts.bioengr.uic.edu/castp/examples.php

Molecular Dynamics

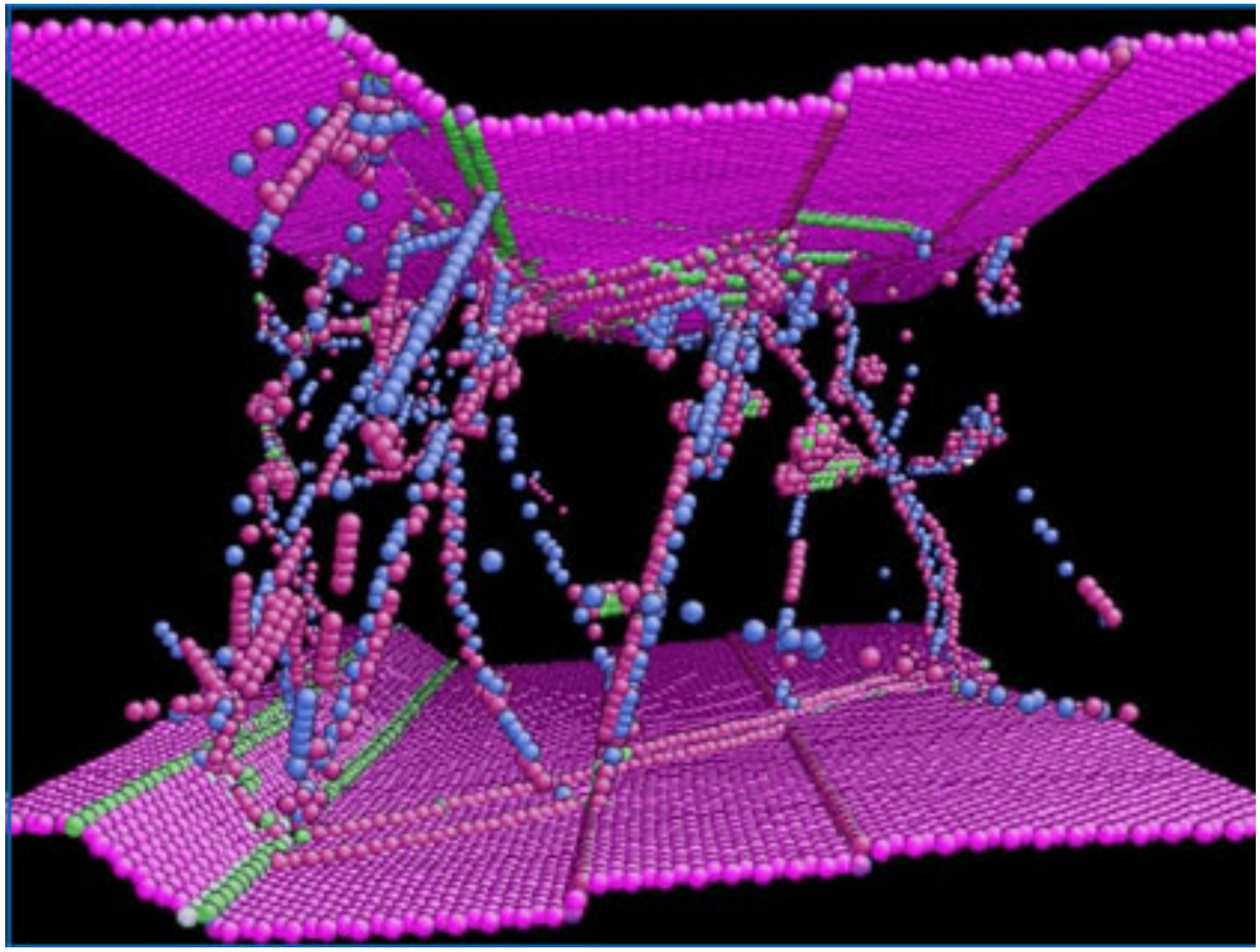


Image: MIT OpenCourseWare

Computational finance

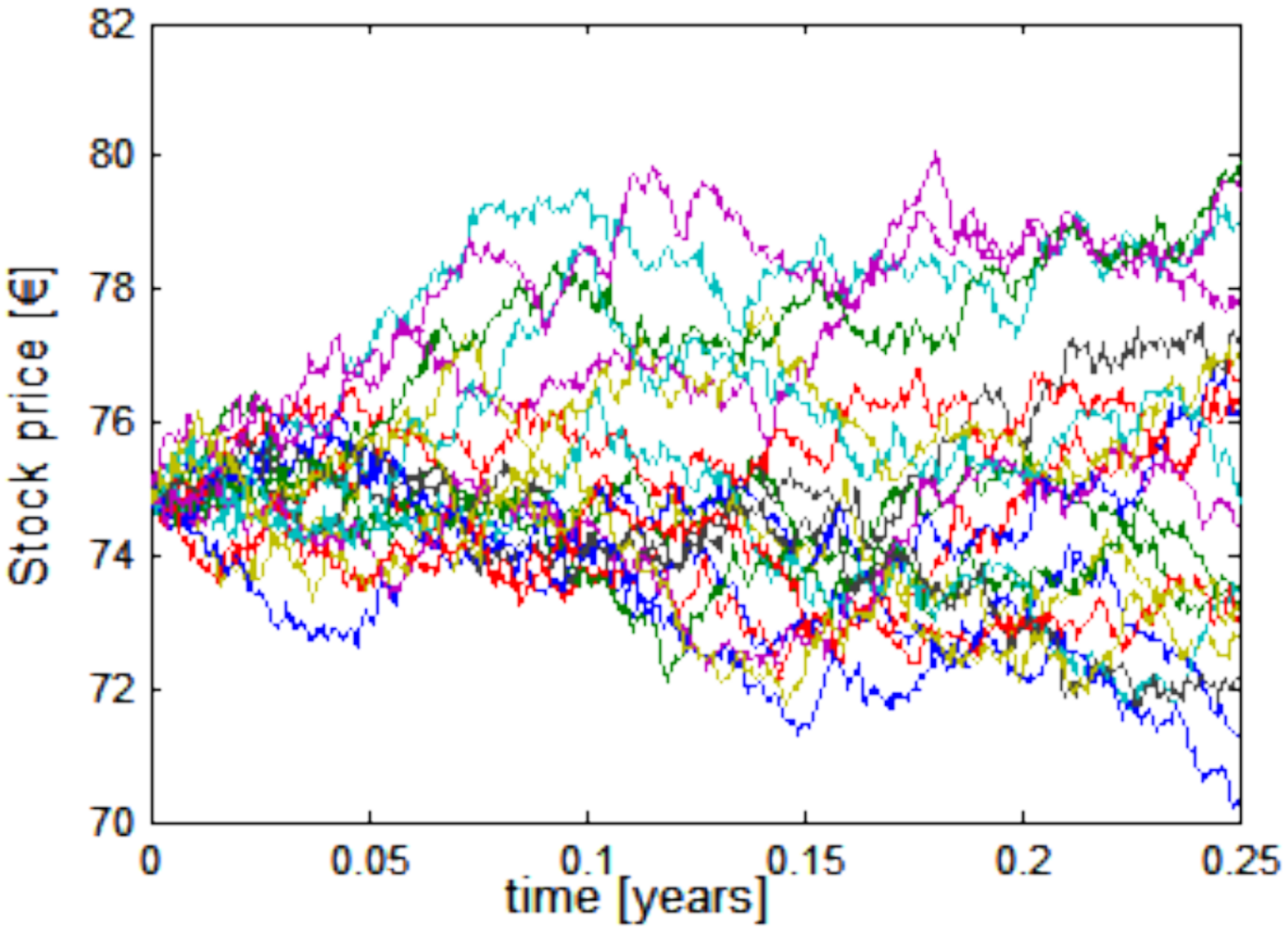


Image: http://www.cwi.nl

Elements for good computational scientist

Adept at programming

Domain specific Knowledge

Background in Applied Mathematics and Numerical Analysis