

Length scales in Nature

1 mm



Grain of sugar, small insects, etc

1 km



Brooklyn bridge

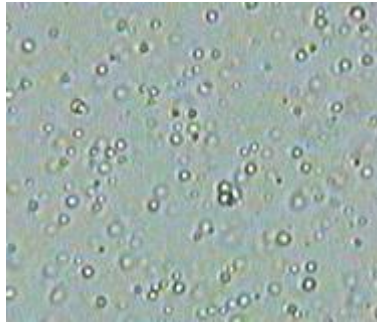
10^{-3} m

1 m

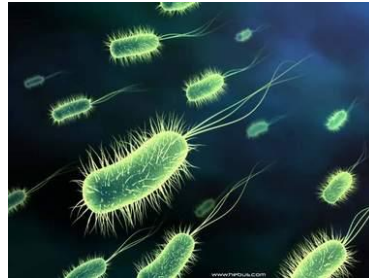
10^3 m

1 micron (1 μ m)

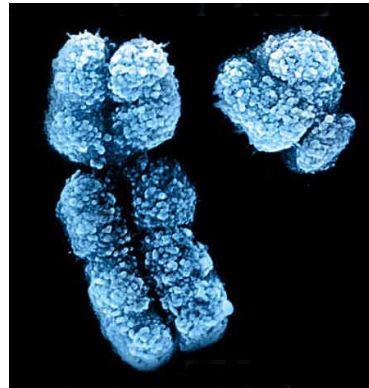
Particles in smoke, milk, etc
(1-20 μ m)



Bacteria
(1-10 μ m)



Human Chromosome
(2 - 10 μ m)



1000 km



10⁻⁶

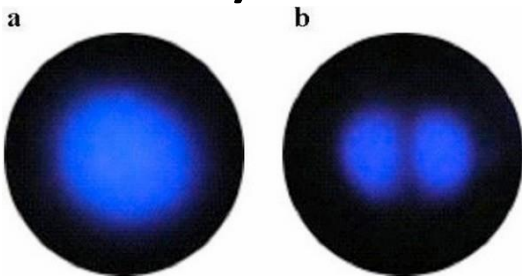
10⁻³

1 m

10³

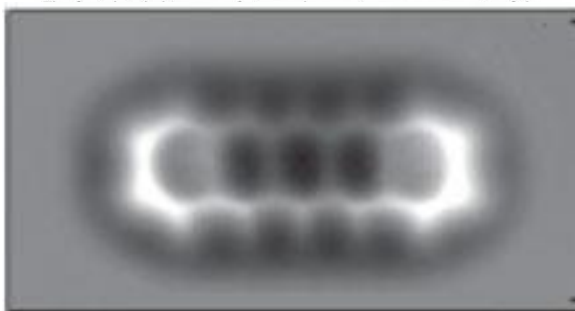
10⁶

**1 nanometer = 10 Angstrom
(1 nm = 10 Å)**

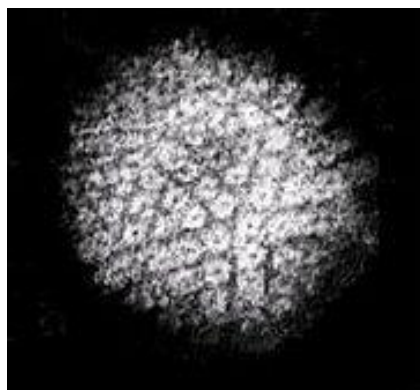


Atom (1 Å)

**Molecule
(1nm)**



Virus (>10 nm)



**1,000,000 km
(3 light seconds)**



10^{-9}

10^{-6}

10^{-3}

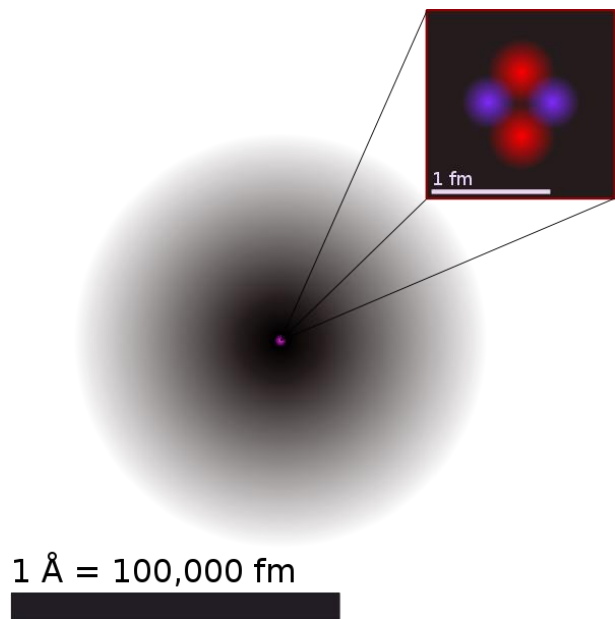
1 m

10^3

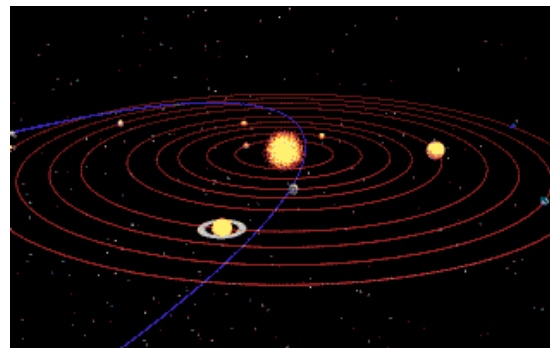
10^6

10^9

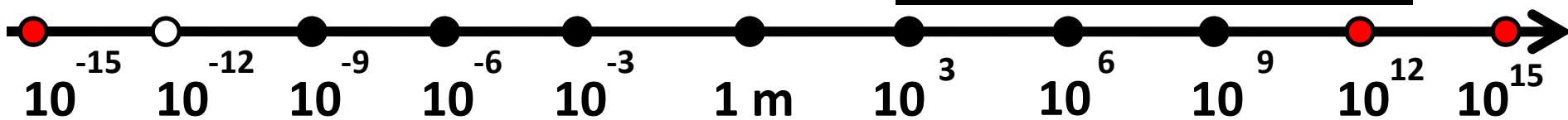
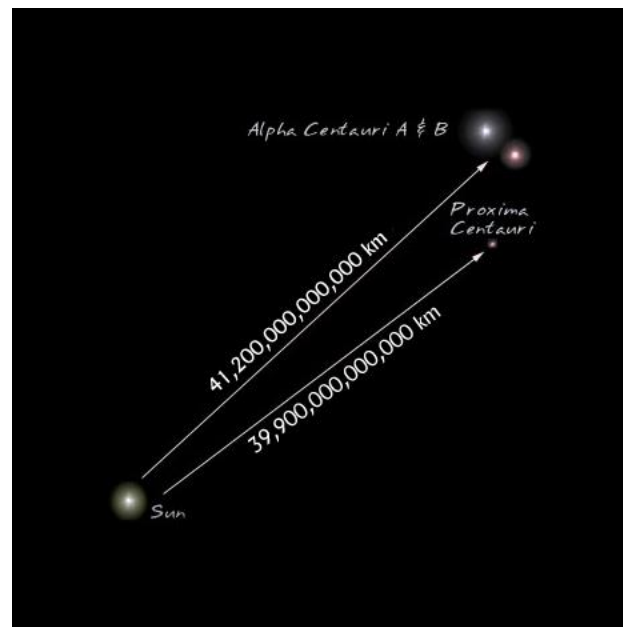
Proton, neutron, atomic nucleus



10^{12} m = 1 billion km \approx 1 light hour



10^{16} m \approx 1 light year



Homework 2

Problem 0.

Watch the documentary called “Cosmic Voyage” at

<https://www.youtube.com/watch?v=GTiDfxATYa4>

paying particular attention to the length scales displayed.

Now, it is time for you to explore the different scales of the universe by going to

<http://htwins.net/scale2/>

Problem 1.

Estimate the number of atoms in a grain of salt. Assume the grain to be a cube 1x1x1 mm, and each atom to be a cubic brick of 1 angstrom.

Hint: First you can figure out how many atoms you need to line up single file so that the line is 1mm long. Now account for the cube being 3D.

Problem 2.

Estimate the number of cells in your body, if a typical human cell is about 10 micron in size.

Problem 3 (optional, but fun).

Come up with a way to experimentally measure width of a sheet of paper. Explain your method, perform the measurement using your method and report the results.

Please indicate which type of paper did you use (book, printer paper, etc.)