

# Length scales in Nature

1 mm



Grain of sugar, small insects, etc

1 km



Brooklyn bridge

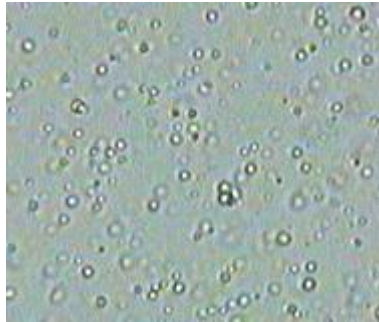
$10^{-3}$  m

1 m

$10^3$  m

1 micron (1 $\mu$ m)

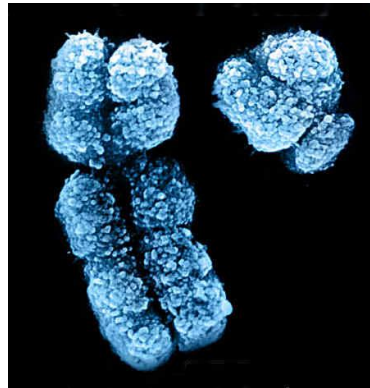
Particles in smoke, milk, etc  
(1-20  $\mu$ m)



Bacteria  
(1-10  $\mu$ m)



Human Chromosome  
(2 - 10  $\mu$ m)



1000 km



10<sup>-6</sup>

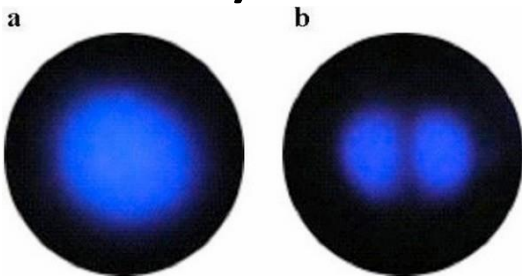
10<sup>-3</sup>

1 m

10<sup>3</sup>

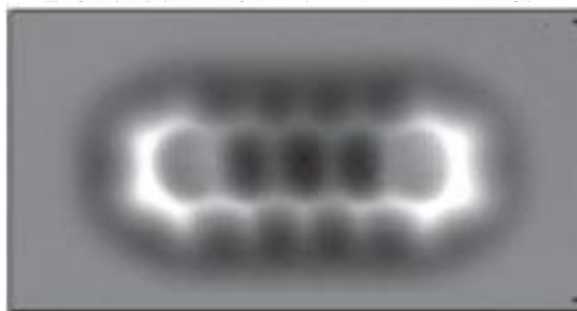
10<sup>6</sup>

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

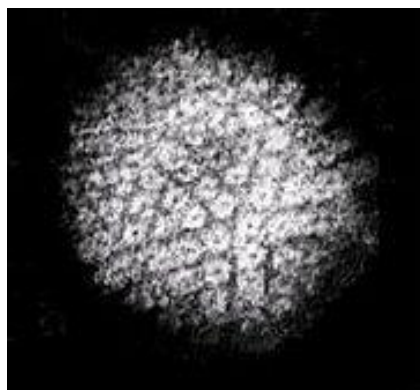


**Atom (1 Å)**

**Molecule  
(1nm)**



**Virus (>10 nm)**



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



**10<sup>-9</sup>**

**10<sup>-6</sup>**

**10<sup>-3</sup>**

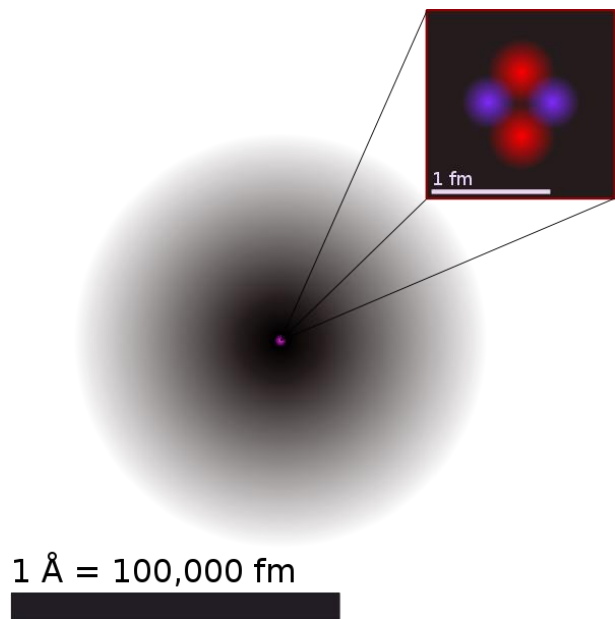
**1 m**

**10<sup>3</sup>**

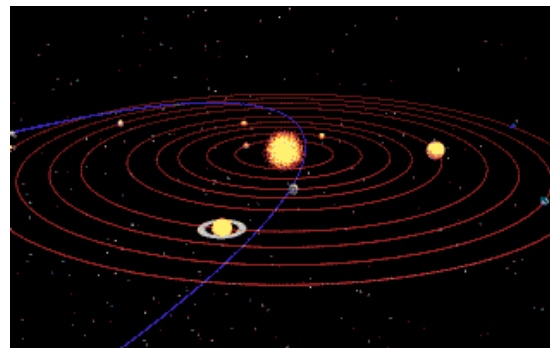
**10<sup>6</sup>**

**10<sup>9</sup>**

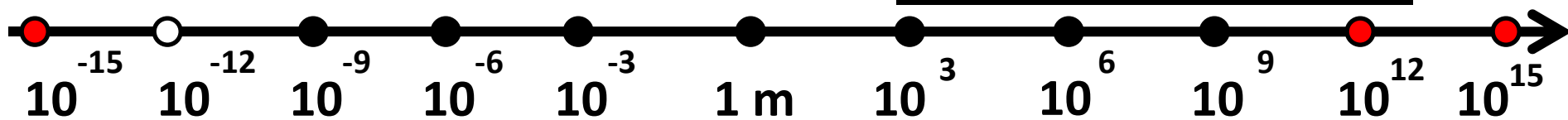
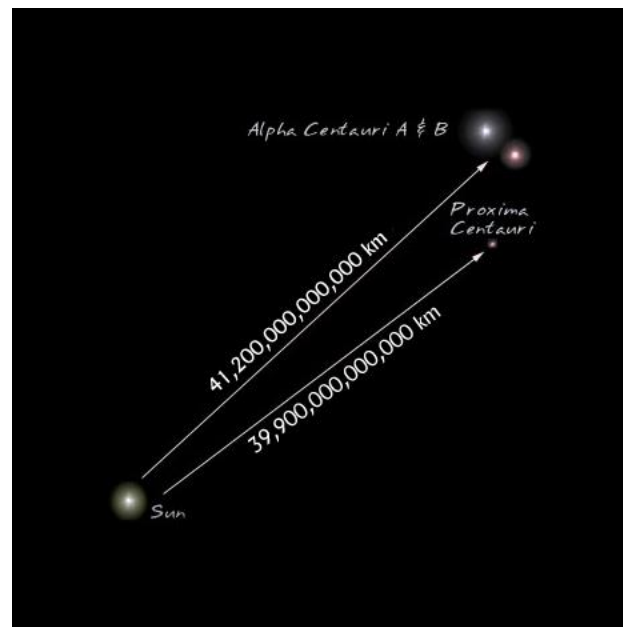
# Proton, neutron, atomic nucleus



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



$10^{16}$  m  $\approx$  1 light year



# Homework 2

## **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.

## **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 write which type of paper did you use (book, printer paper, etc.)