

Length scales in Nature

1 mm



Grain of sugar, small insects, etc

1 km



Brooklyn bridge

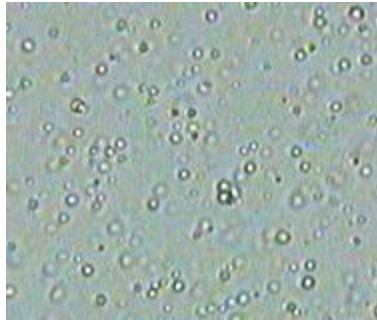
10^{-3} m

1 m

10^3 m

1 micron ($1\mu\text{m}$)

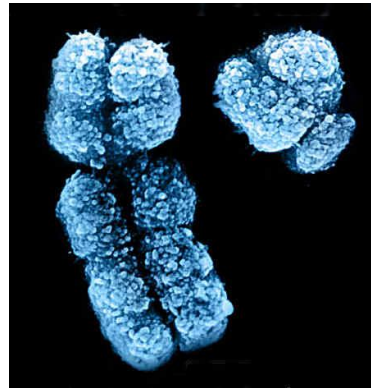
Particles in smoke, milk, etc
($1\text{--}20\ \mu\text{m}$)



Bacteria
($1\text{--}10\ \mu\text{m}$)



Human Chromosome
($2\text{--}10\ \mu\text{m}$)



1000 km



10^{-6}

10^{-3}

1 m

10^3

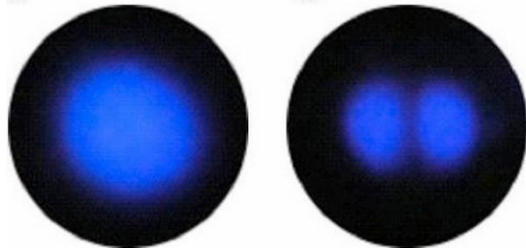
10^6

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

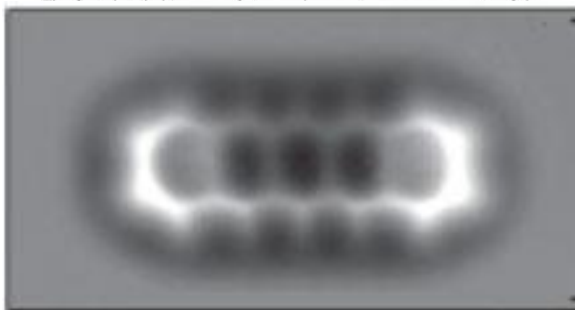
a

b

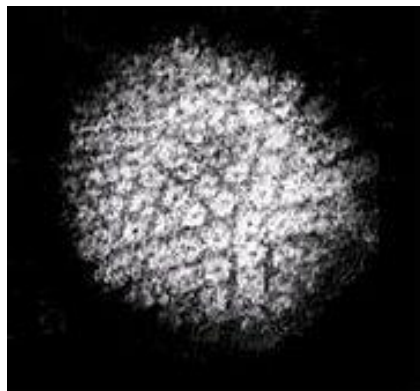
Atom (1 Å)



Molecule
(1nm)



Virus (>10 nm)



1,000,000 km
(3 light seconds)



10^{-9}

10^{-6}

10^{-3}

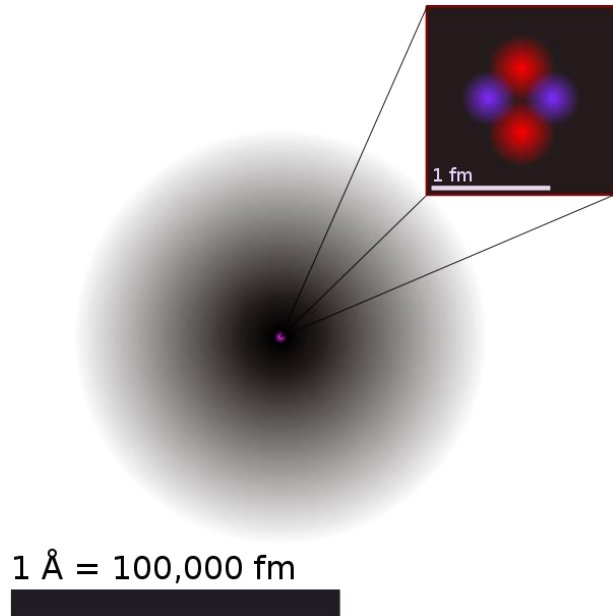
1 m

10^3

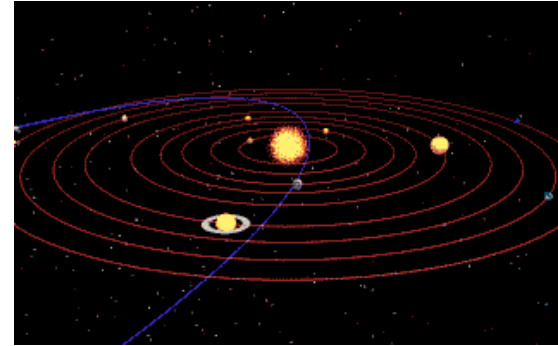
10^6

10^9

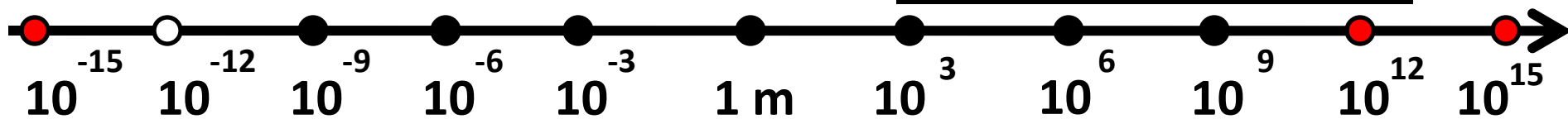
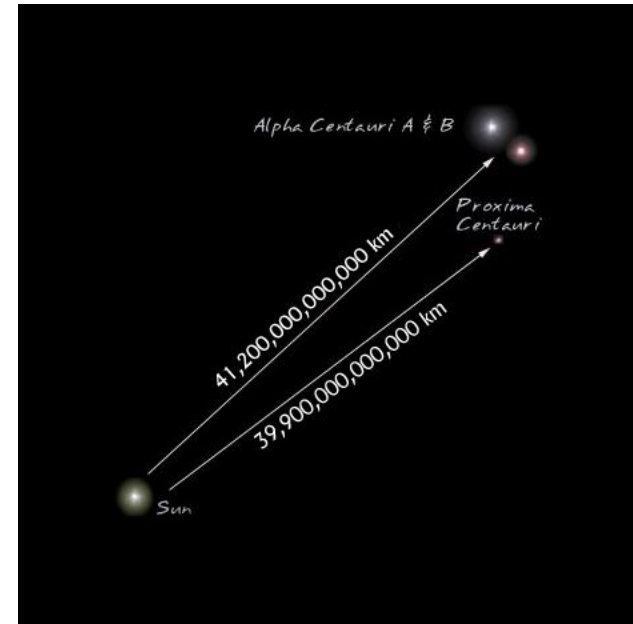
Proton, neutron, atomic nucleus



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



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

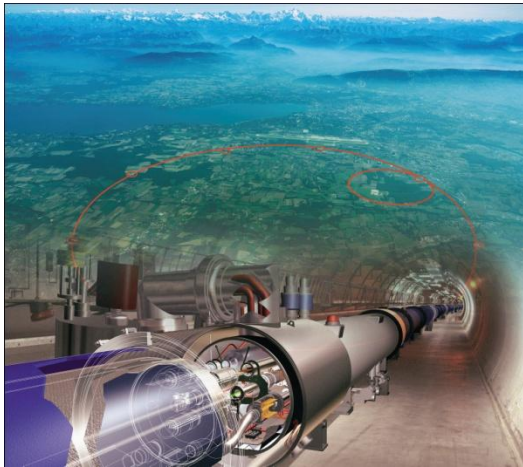


Modern Physics

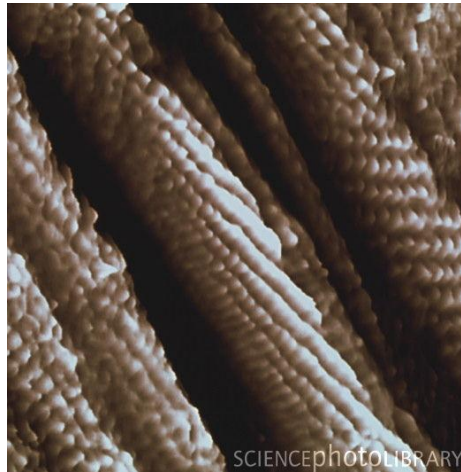
High Energy Physics

Condensed Matter Physics

Astrophysics & Cosmology



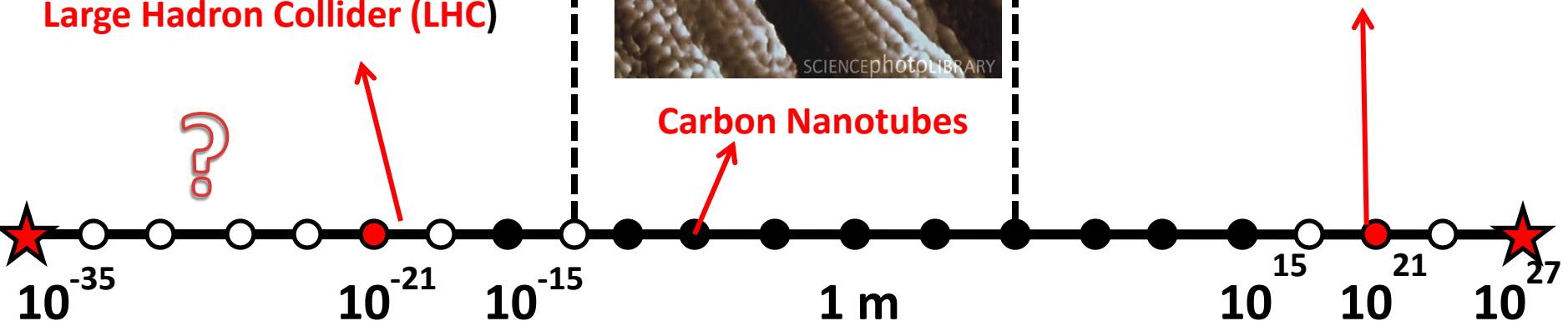
Large Hadron Collider (LHC)



Carbon Nanotubes



Our Galaxy (Milky Way)



Homework

Problem 1

Water molecule can be approximated as a sphere of radius $2 \text{ \AA}$ ($1 \text{ \AA} = 10^{-10} \text{ m}$, is called Angstrom). Estimate how many molecules is there in one glass (200 cm^3) of water.

Problem 2

A nucleus of a human cell has radius about $5 \mu\text{m}$ (1 micrometers). Roughly DNA takes roughly 1% of its volume. Based on this information, find the total length of human DNA in each cell. Model DNA as a long wire with 1 nm radius.