

# Zoooooom: paramaaNu se a.ntariiksha tak

(P. Philip aur Phyllis Morrison ke “Powers of 10” par aadhaarit  
Prof. Mayank Vahia ke “Unity of Science” bhaashaN se)

Amol Dighe

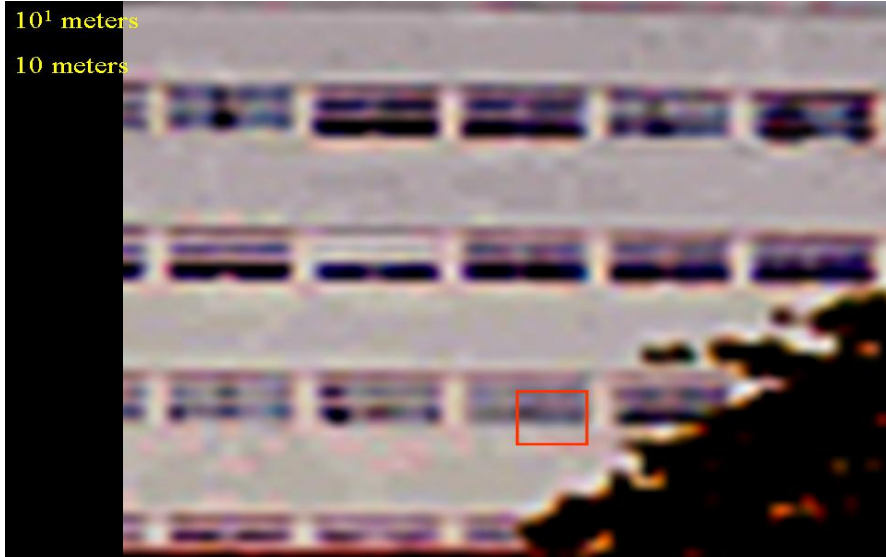
saidhaa.ntiki bhautiki department  
Tata muulabhut sa.nshodhan sa.nsthaan

Hindi diwas, Sep 14, 2006

shuruuat daftar se:  $1m \times 1m$



zoom 1:  $10m \times 10m$



# zoom 2: 100m × 100m

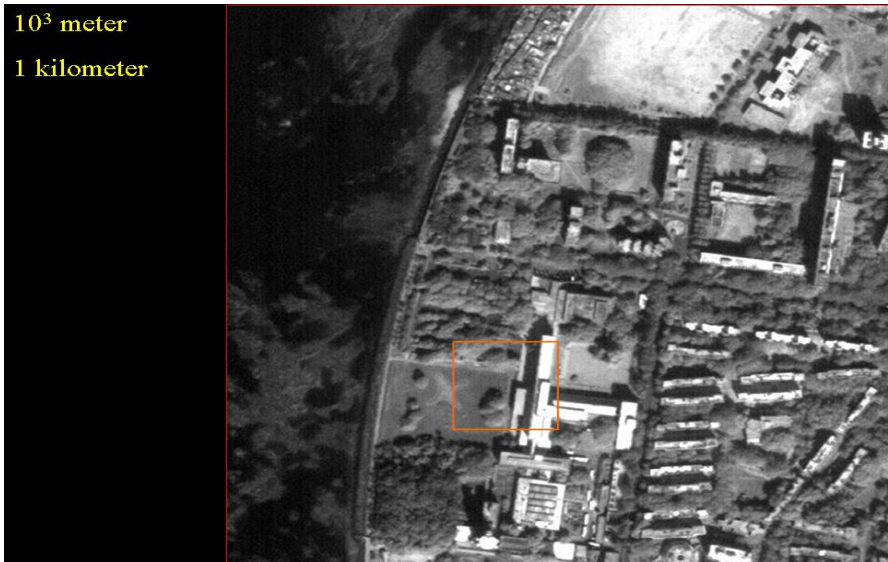
10<sup>2</sup> meters

100 meters



# zoom 3: 1 km $\times$ 1 km: Navy Nagar

10<sup>3</sup> meter  
1 kilometer



# zoom 4: BaMbai nagariyaa

10<sup>4</sup> meters

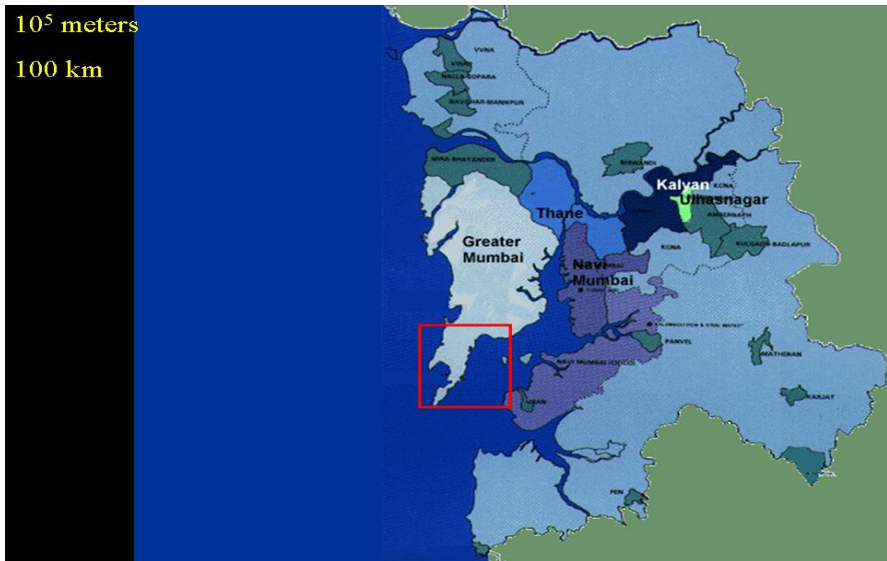
10 km



# zoom 5: Mumbai tathaa Thane zilla: train se 3 gha.nTe

10<sup>5</sup> meters

100 km



# zoom 6: Goa se Karachi tak: train se ek din

$10^6$  meters

1000 km





# zoom 7: lagbhag saarii prithvi

$10^7$  meters

10000 km



# zoom 8: bas prithvi, aur kuchh nahii

$10^8$  meters

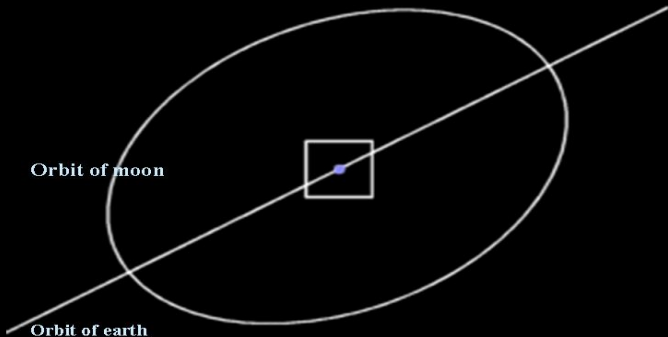
100,000 km



# zoom 9: chaa.nd kii kakshhaa: prakaash leta hai 3 sec

$10^9$  meters

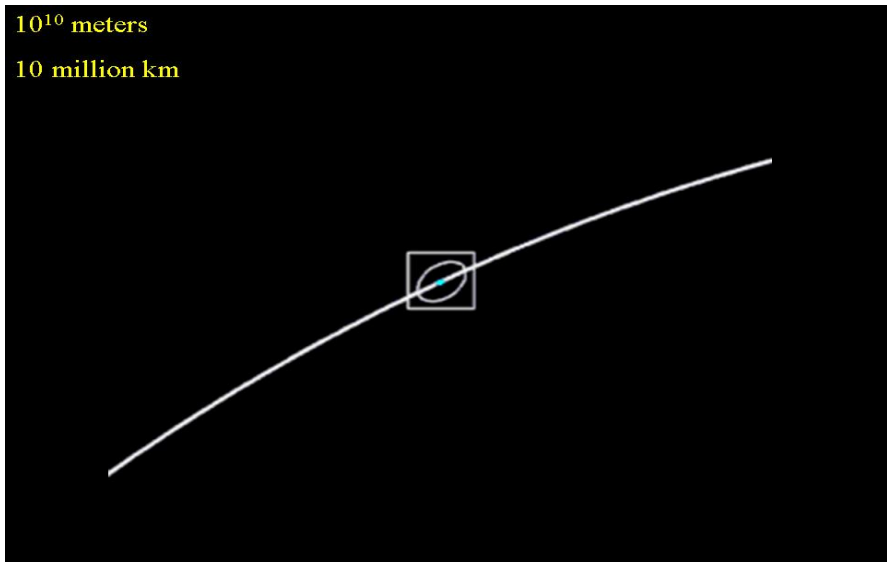
1 million km



# zoom 10: naa kol aajuu-baajuu me.n

$10^{10}$  meters

10 million km

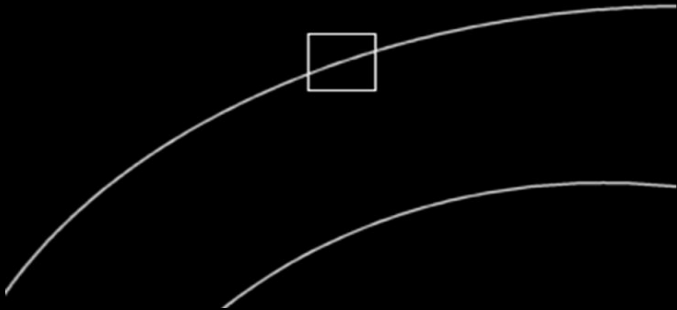


# zoom 11: shukra tathaa ma.ngal, lekin baraso.n baad

$10^{11}$  meters

100 million km

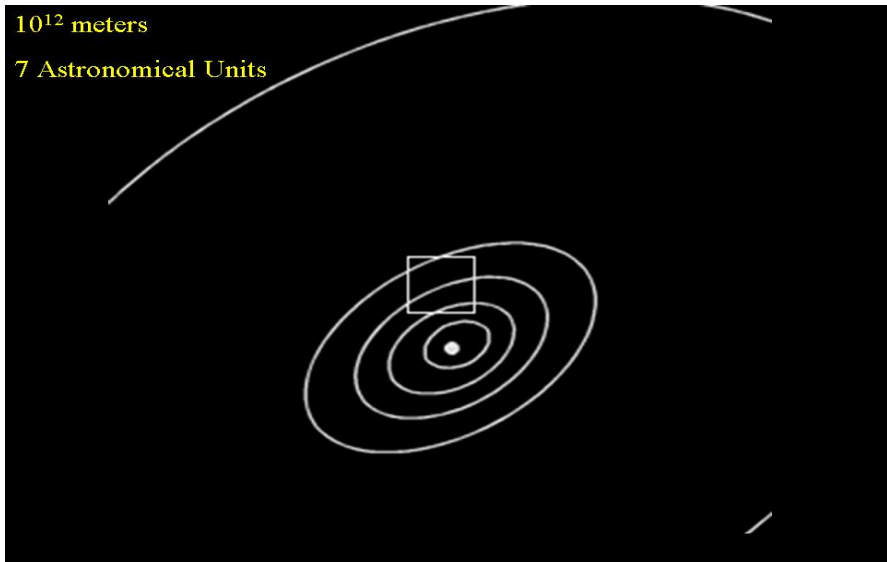
0.7 Astronomical Units



# zoom 12: suuryamaalaa ke choTe graha

$10^{12}$  meters

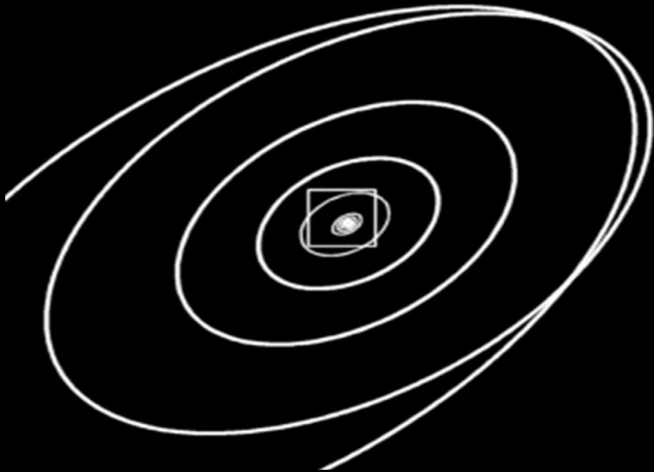
7 Astronomical Units



# zoom 13: Pluto bhii aa gayaa sameT me.n

$10^{13}$  meters

70 AU



# zoom 14: hamaarii suuryamaalaa, phir sannaaTaa

$10^{14}$  meters

700 AU





# zoom 15: aur sannaaTa: kol hai bhii yaa nahii ?

$10^{15}$  meters

7,000 AU



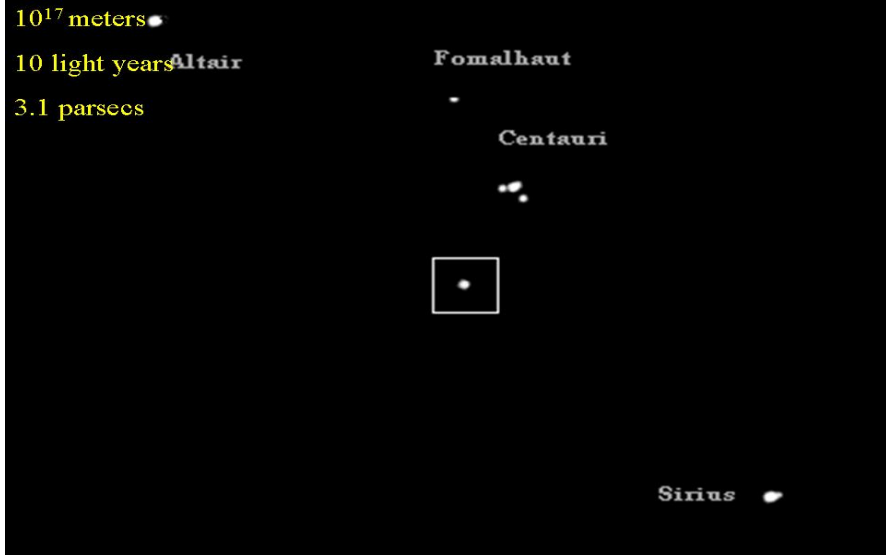
# zoom 16: kitane akele hai.n ham....

$10^{16}$  meters

1 Light year



# zoom 17: aakhir-kaar, kuchh paDosii...

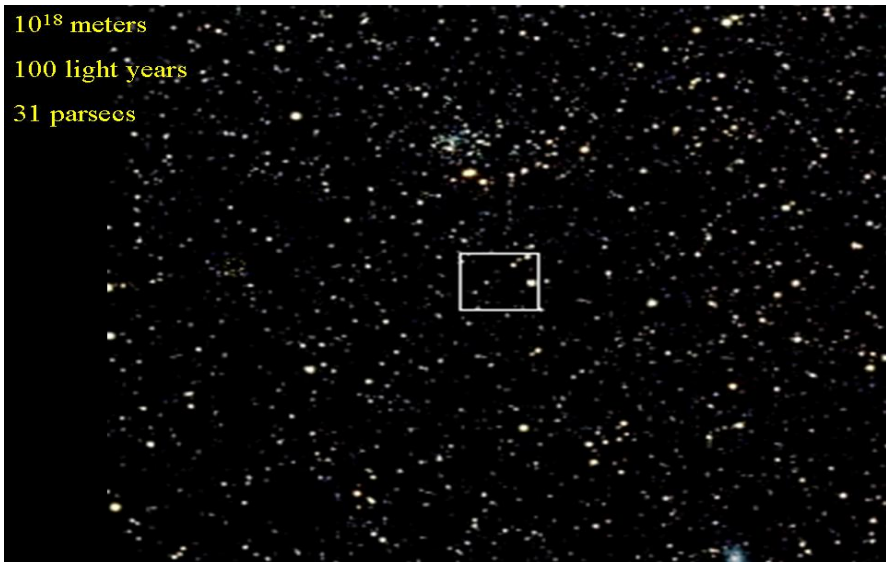


# zoom 18: hamaarii “suuryamaalaa colony”

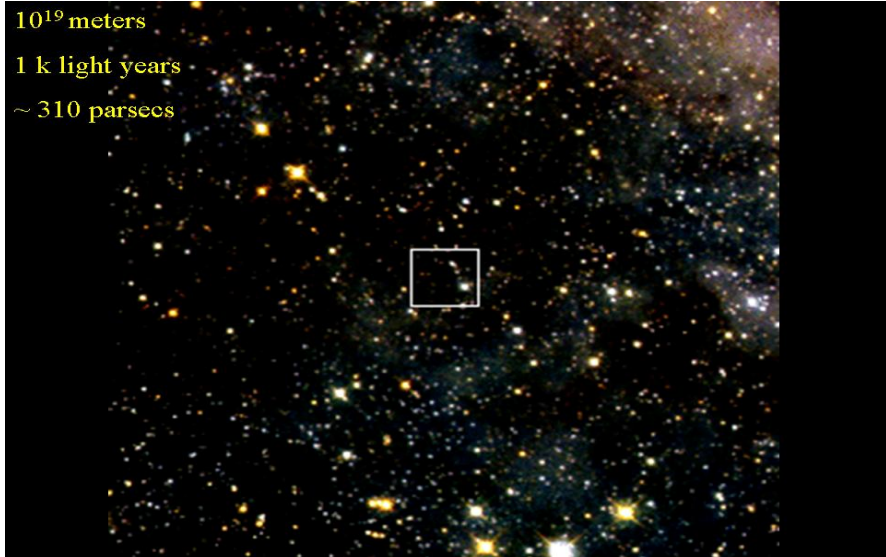
$10^{18}$  meters

100 light years

31 parsecs

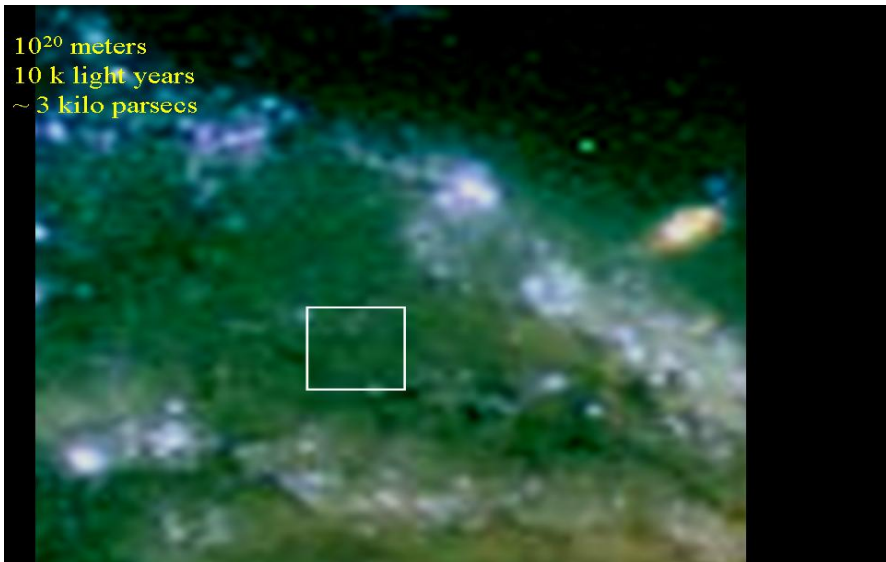


# zoom 19: aakash-ga.ngaa kaa ek konnaa



# zoom 20: aakaash-ga.ngaa aur bahut baDii hai...

$10^{20}$  meters  
10 k light years  
~ 3 kilo parsecs

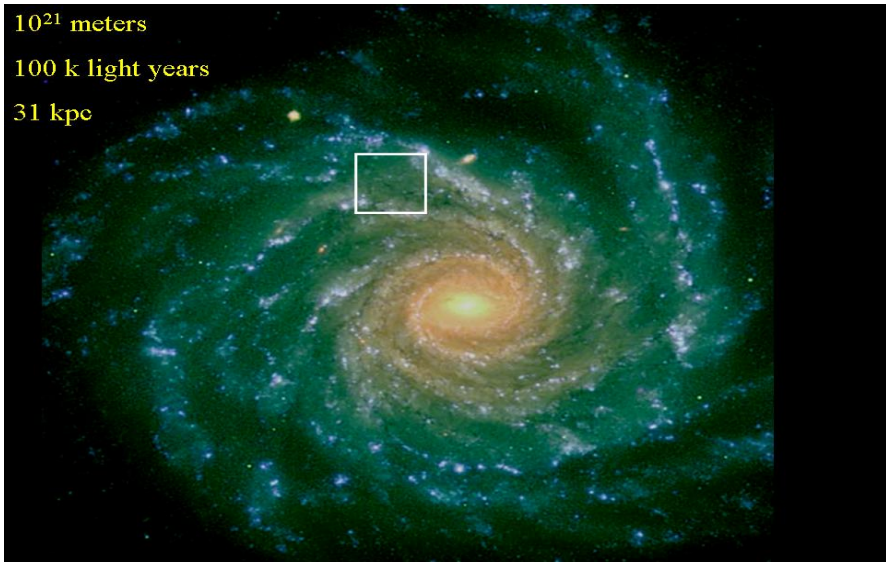


# zoom 21: ma.ndaakini (Milky Way)

$10^{21}$  meters

100 k light years

31 kpc



# zoom 22: kuchh chhoTe paDosii

$10^{22}$  meters

1 Mega Light years

310 kpc





# zoom 23: najadiikii galaxies

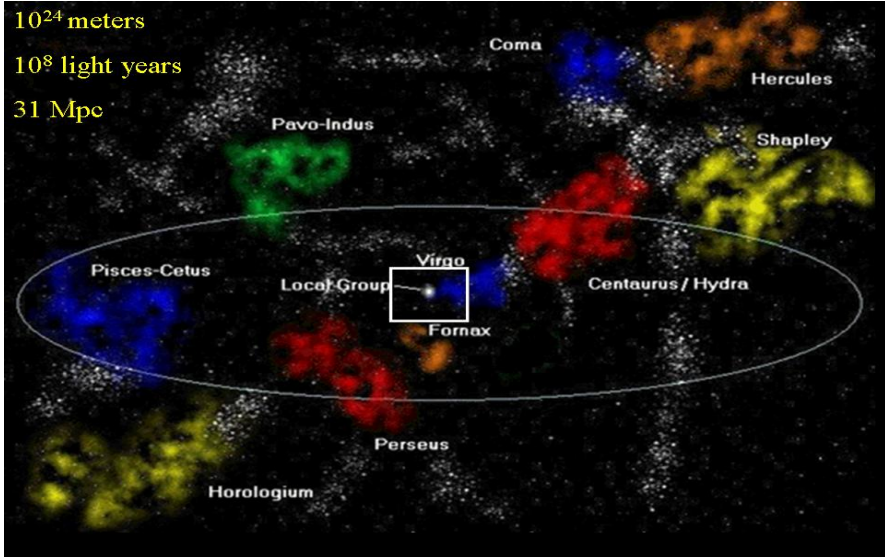
$10^{23}$  meters

10 Mega light years

3.1 Mpc



# zoom 24: prakaash ko bhi lagate hai.n 10 koTii saal

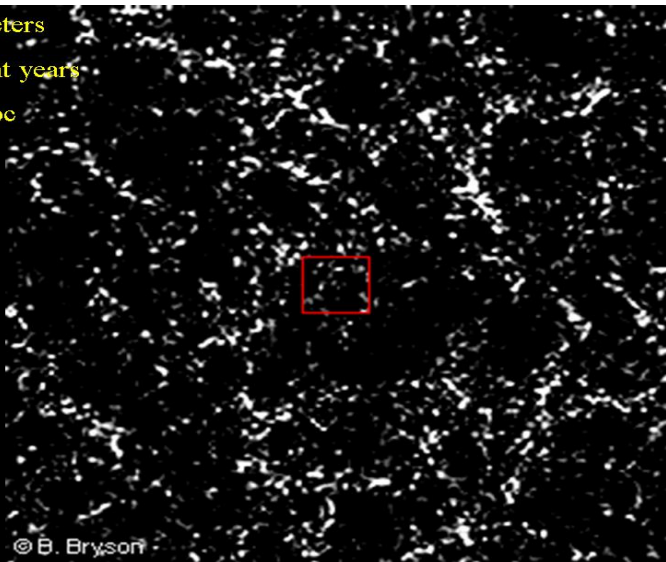


# zoom 25: One billion light years !

$10^{25}$  meters

$10^9$  light years

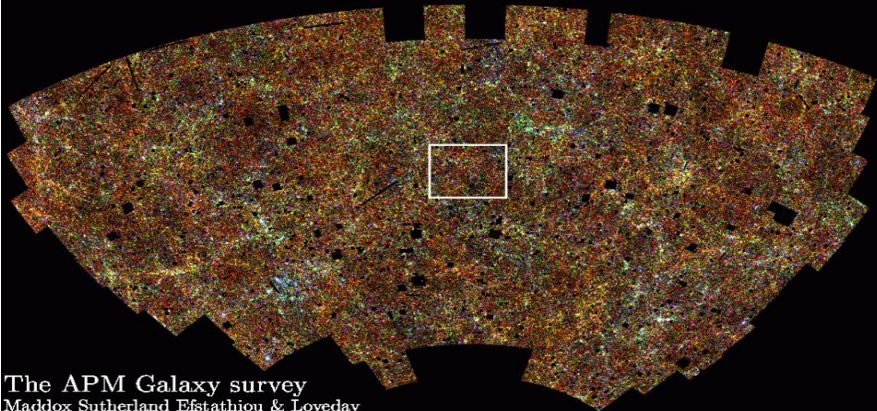
310 Mpc



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# zoom 26: vishva bas itanaa hii baDaa hai...

$10^{26}$  meters  
 $10^{10}$  light years  
3100 Mpc



The APM Galaxy survey  
Maddox Sutherland Efstathiou & Loveday

**Accelerating Universe**

punaH daftar me:  $1m \times 1m$



zoom (-1):  $0.1m \times 0.1m \equiv 10cm \times 10cm$

$10^{-1}$  meters

0.1 meters

10 cm



zoom (-2):  $0.01m \times 0.01m \equiv 1cm \times 1cm$

$10^{-2}$  meters

1 centimeter



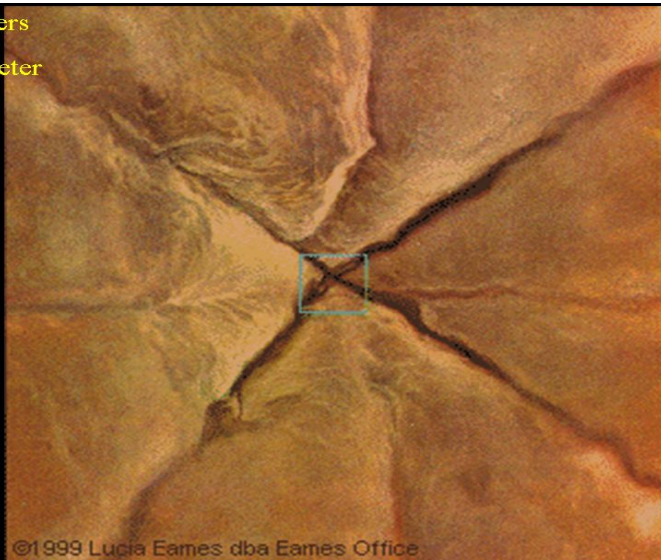
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zoom (-3):  $0.001m \times 0.001m \equiv 1mm \times 1mm$

$10^{-3}$  meters

1 millimeter



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# zoom (-4): tvachaa ke ek chhed mein



# zoom (-5): shveta rakta-peshii (white blood cell)

$10^{-5}$  meters

0.01 mm

10 microns



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# zoom (-6): peshii kavach (also: **light wavelength**)

$10^{-6}$  meters

1 micron

Micro-machines



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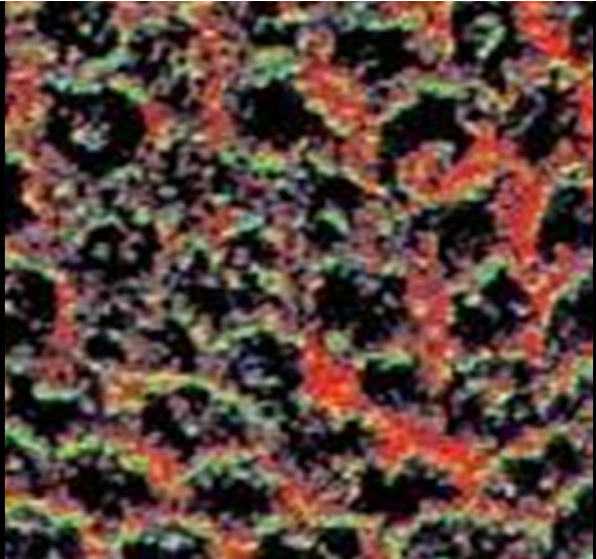


# zoom (-7): peshii ke a.ndar

$10^{-7}$  meters

0.1 micron

100 nm

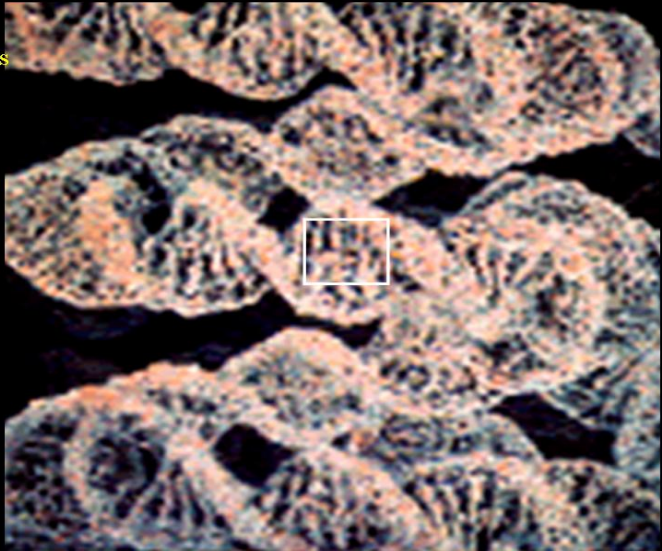


# zoom (-8): guNa-suutra (DNA)

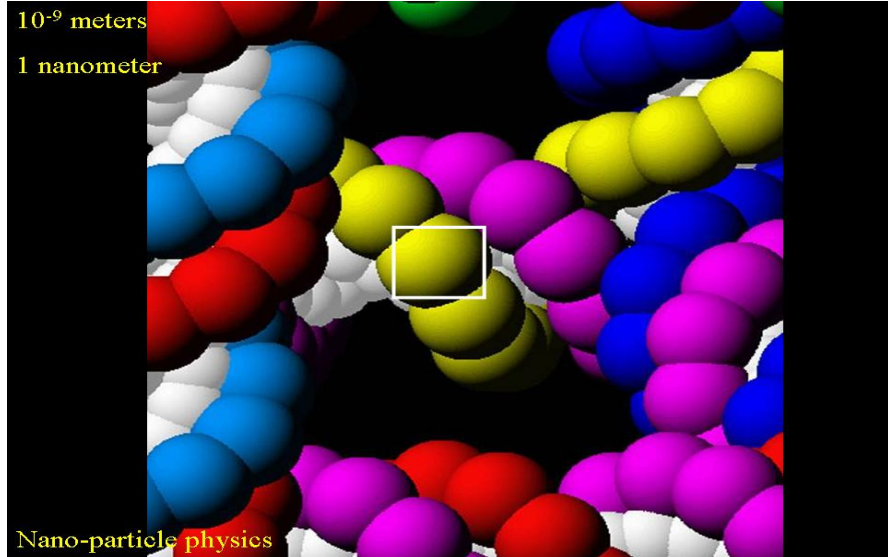
$10^{-8}$  meters

0.01 microns

10 nm



# zoom (-9): amino acids: nanophysics kaa daur

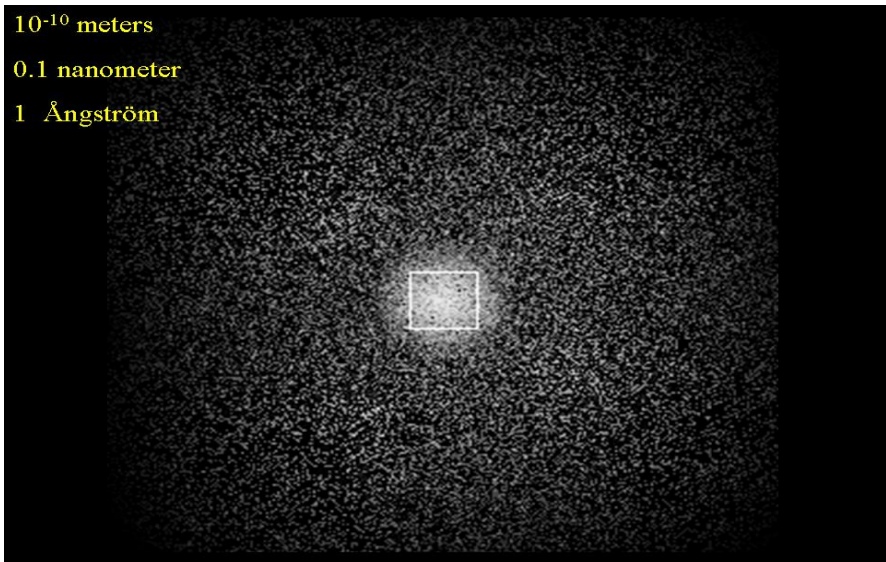


# zoom (-10): paramaaNu: electron cloud

$10^{-10}$  meters

0.1 nanometer

1 Ångström





# zoom (-11): nucleus kii khoj mein

$10^{-11}$  meters

0.1 Ångström



**Note: It is force that is central to Physics**



# zoom (-12): nucleus to mil gayaa, par fir se sannaaTaa

$10^{-12}$  meters

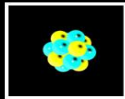
1 picometer



# zoom (-13): nucleus ke a.ndar: proton va neutron

$10^{-13}$  meters

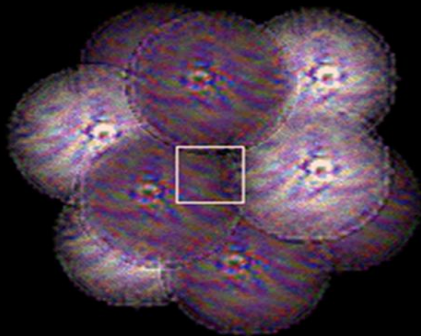
100 femtometers



# zoom (-14): kyaa hai proton-neutron ke bhiitar ?

$10^{-14}$  meters

10 femtometers



# zoom (-15): quarks ? gluons ? ham khoj rahe hai.n

$10^{-15}$  meters

1 femtometer



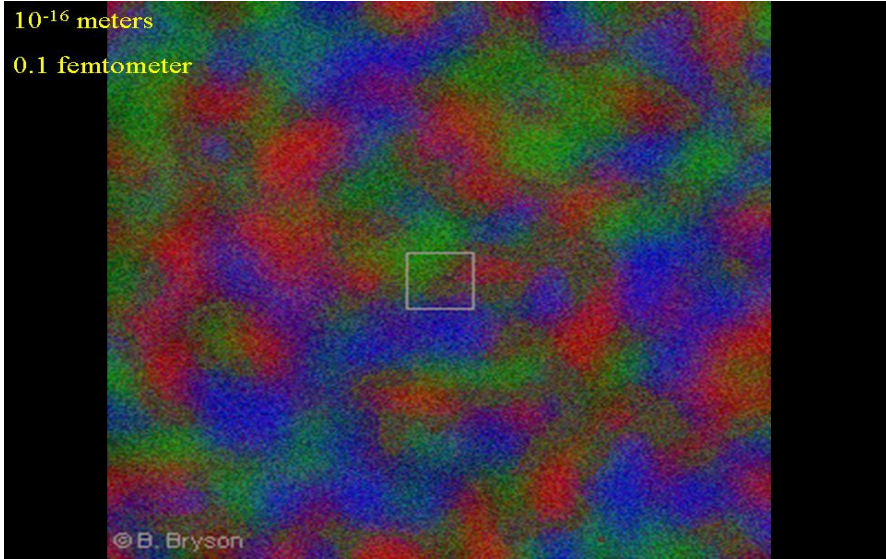
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# zoom (-16): chitra adhik dhu.ndhalaataa huaa

$10^{-16}$  meters

0.1 femtometer



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- alag alag jhaa.nkiyaa.n alag alag “scales” par
- bhinna scales par dekhane ke liye bhinna takaniik, alag alag scales ke abhyaas kii alag alag shaakhaae.n
- zoom 1-9: **Geography**,  
zoom 10-26: **Astrophysics**,  
zoom (-1)-(-8): **Biology, Condensed matter physics**,  
zoom (-8)-(-9): **Chemistry**  
zoom (-9)-(-14): **Atomic and nuclear physics**,  
zoom (-15) →: **High energy physics**

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