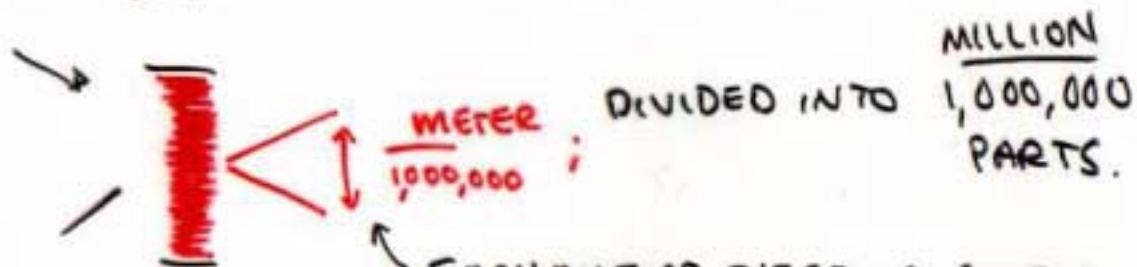


□ LENGTH SCALES

- METER - M - IS BASIC MEASUREMENT QUANTITY FOR DISTANCE: METER IS A "UNITS OF MEASURE".



- SMALLER UNITS BY DIVIDING UP THE METER:



MADE UP NAME TO CONVEY SMALLNESS OF THE UNITS.

EACH ONE OF THESE IS GIVEN A NAME "MICRO"

$$1 \text{ METER} = 1,000,000 \text{ "MICROMETERS"}$$

① RED BLOOD CELL = 20 MICRONS (OR = $\frac{20}{1,000,000}$ METER - JUST EASIER TO SAY!)
SOMETIMES "MICRON"

□ BIG DISTANCES: LIGHT-YEARS

(PAGE 3-3 "BOX")

$C = 186,000 \frac{\text{MILES}}{\text{SEC}} = 300,000 \frac{\text{KM}}{\text{SEC}} = 300,000,000 \frac{\text{M}}{\text{SEC}}$ FAST.

↑
"SPEED OF LIGHT"

- MAXIMUM SPEED FOR ANY OBJECT IN THE UNIVERSE
- EXPERIMENTAL FACT.

C CAN BE USED TO MEASURE DISTANCE.

Ex: SANTA BARBARA IS "2 HOURS" FROM LA.

A DISTANCE IS DESCRIBED BY A "TIME"?!?

SPEED = 65 MPH = 65 $\frac{\text{MILES}}{\text{HOUR}}$: DISTANCE = $\frac{65 \text{ MILES}}{\text{HOUR}} \cdot 2 \text{ HOURS} = \boxed{130 \text{ MILES}}$

130 MILES = "2 CAR-HOURS!"

A LIGHT-SEC = $C \cdot 1 \text{ SEC} = \frac{2}{3}$ OF THE WAY TO THE MOON

A LIGHT-MINUTE = $C \cdot 60 \text{ SEC} \approx \frac{1}{8}$ OF THE WAY TO THE SUN

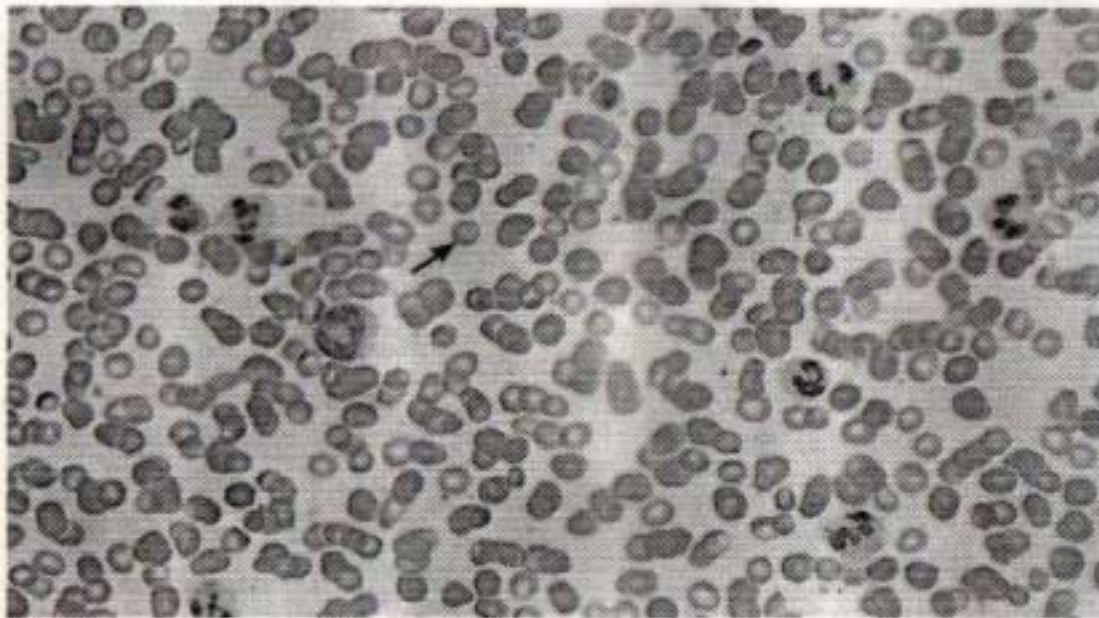
A LIGHT-HOUR = 60 LIGHT-MINUTES \approx DISTANCE TO SATURN ~~!~~

A LIGHT-DAY = 24 LIGHT-HOURS \approx 8 TIMES BIGGER THAN THE ENTIRE SOLAR SYSTEM

A LIGHT-YEAR = 365 LIGHT-DAYS $\approx \frac{1}{4}$ OF THE WAY TO THE NEAREST STAR!

HUMAN RED BLOOD CELLS

H ← $\frac{\text{METER}}{1,000,000} \times 20 \approx 20 \text{ MICRON}$ SMALL!



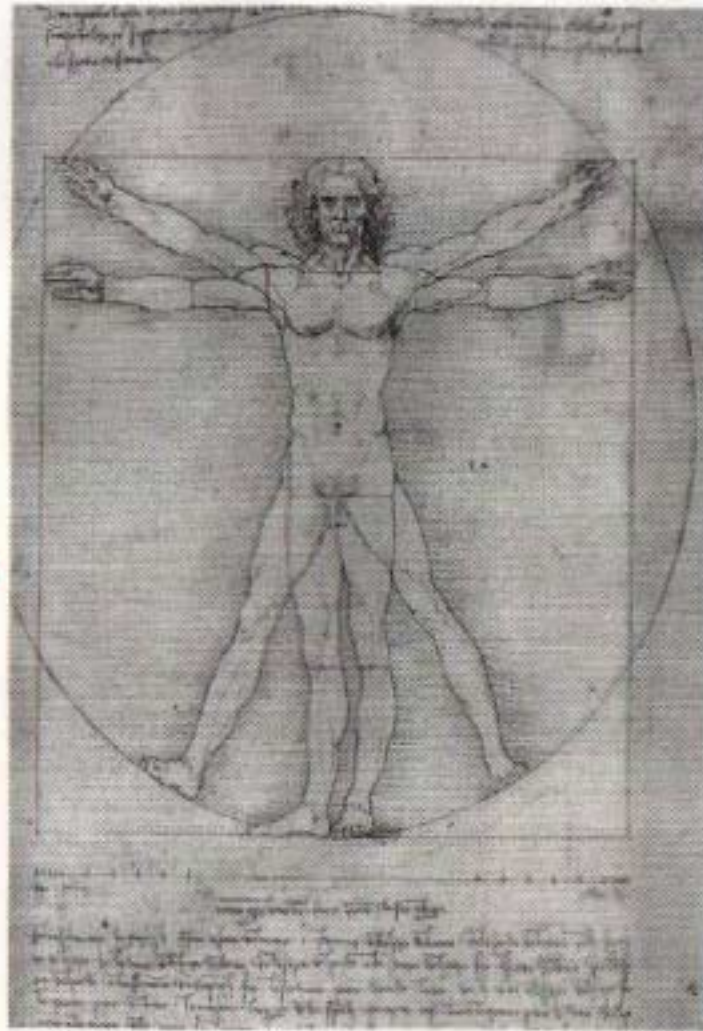
YOU CAN GO MUCH SMALLER!



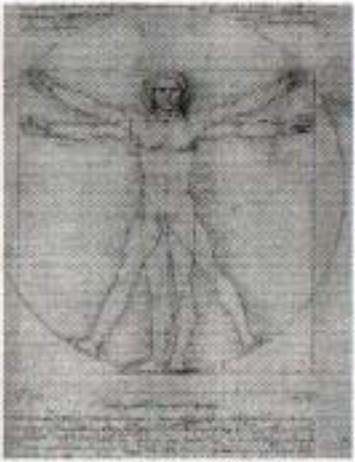
JUMP OF
1,000,000
IN
SIZE

MICRON

= ONE MILLIONTH
OF A METER.



~ 2 METERS.



2 METER

X
1,000,000



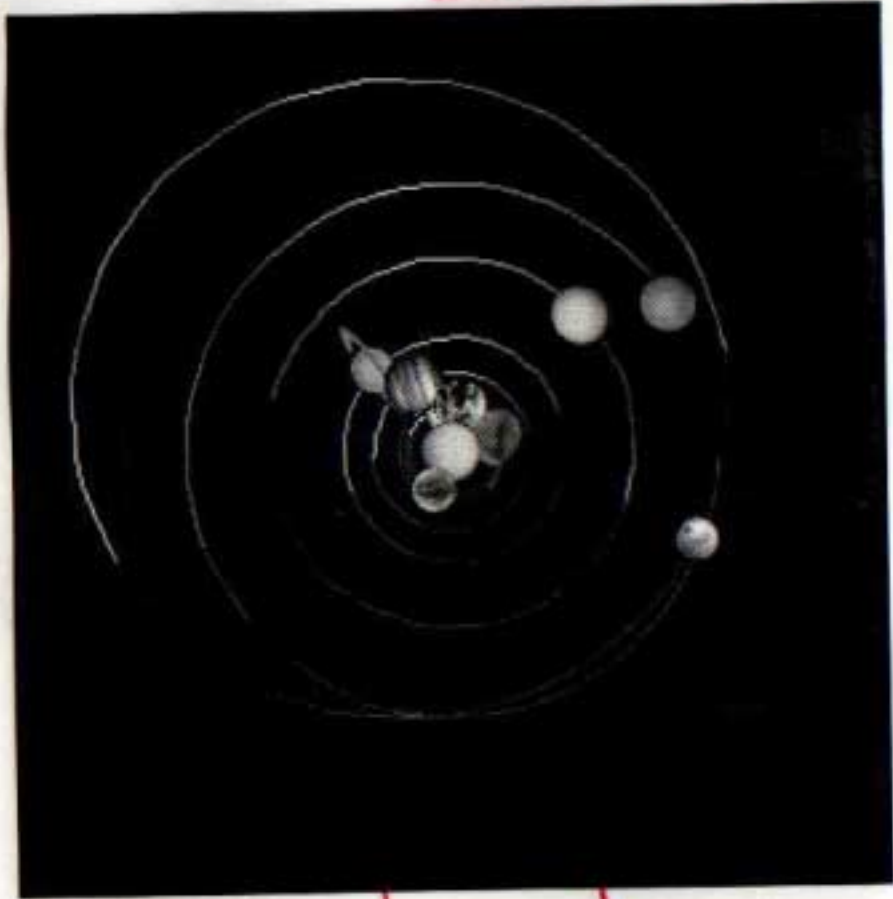
12 MILLION METERS

A.U.

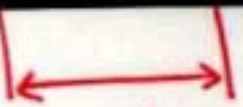


INNER PLANETS

WHOLE SOLAR SYSTEM.



x 1,000,000



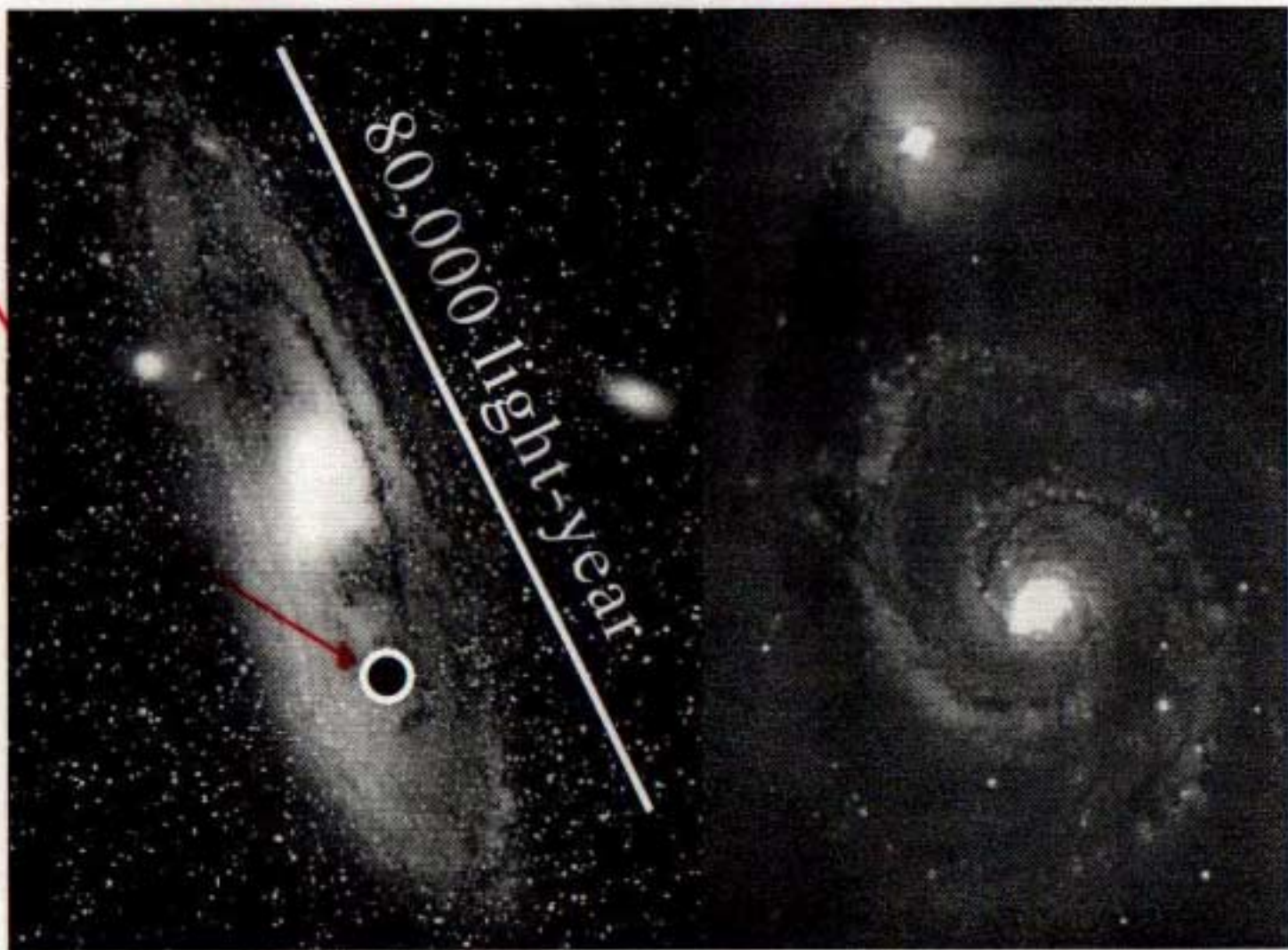
≈ 10" ASTRONOMICAL UNIT"
DISTANCE FROM EARTH TO
SUN

"ANDROMEDA" M31

"WHIRLPOOL" M51



400 Ly



(SOLAR SYSTEM) x 1,000,000 \approx 150 LIGHT-YEAR.

□ 150 LY → 150 MILLION LIGHT YEAR

PAGE 3-8

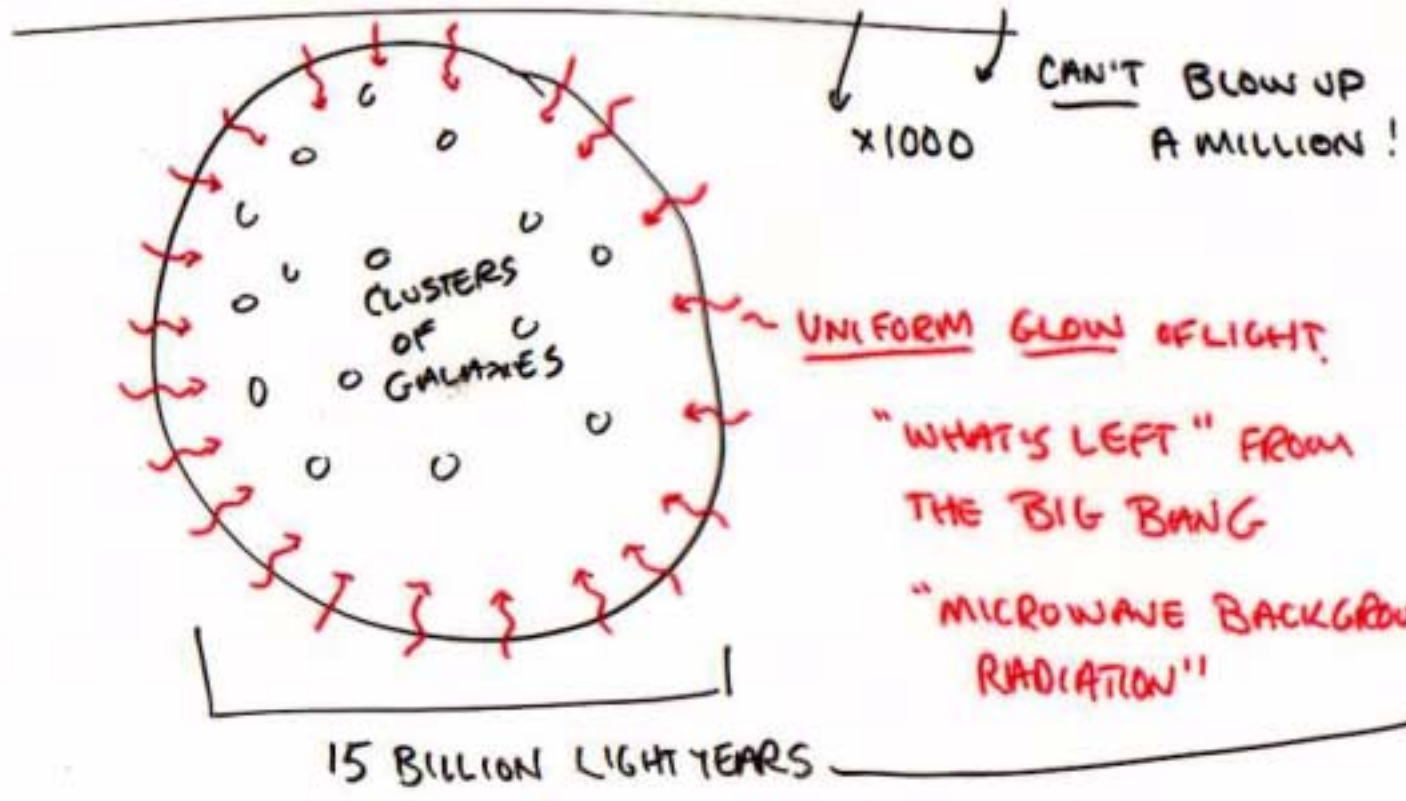
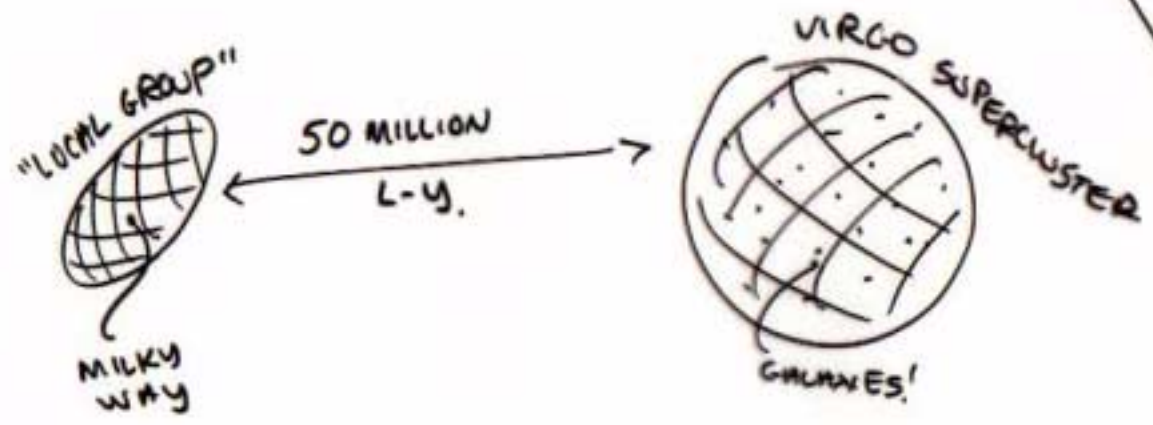
15 BILLION LY =

14,000,000,000,
000,000,000,
00,000 METERS!

BIGGEST
DISTANCE
"SIZE"
OF UNIVERSE

"AGE" OF
UNIVERSE

≈ 15
BILLION
YEARS



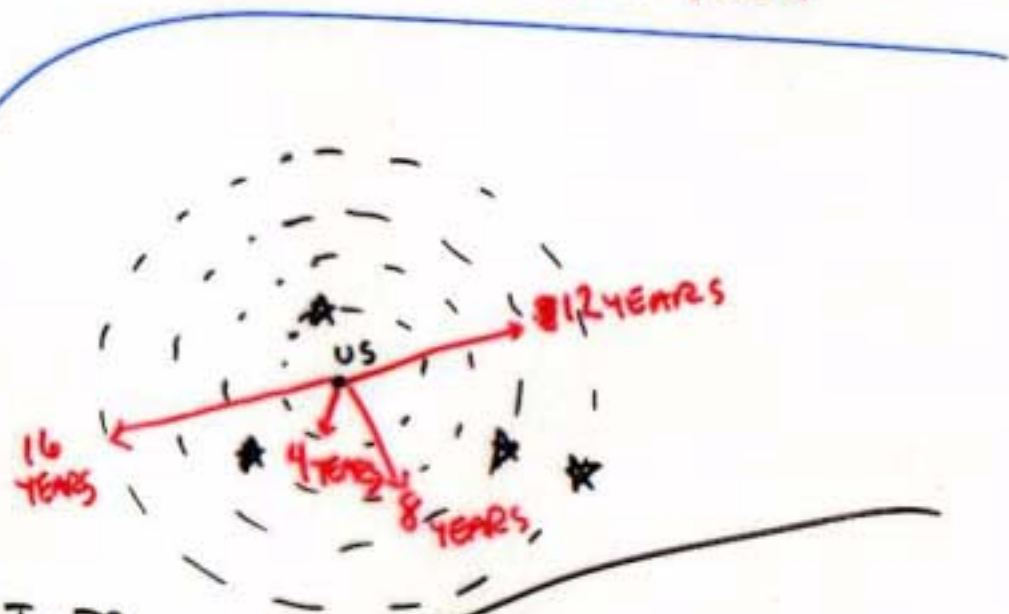
□ PAST AND FUTURE IN THE SKY

[PAGE 3-11]

LIGHT CAN ONLY TRAVEL **SO FAST!**



- THE FARTHER AWAY, THE LONGER IT TAKES LIGHT TO GET HERE.
- FAR STARS ARE SHOWING US THEIR **PAST**.



OUR SIGNALS GO OUT TO THE **FUTURE** OF THE NEARBY STARS!

WE SEE THE **PAST**, AND TALK TO THE **FUTURE** IN THE SKY...