

*I am a man: little do I last
and the night is enormous.
But I look up:
the stars write.
Unknowing I understand:
I too am written,
and at this very moment
someone spells me out.*

OCTAVIO PAZ

It is the
best of
times....



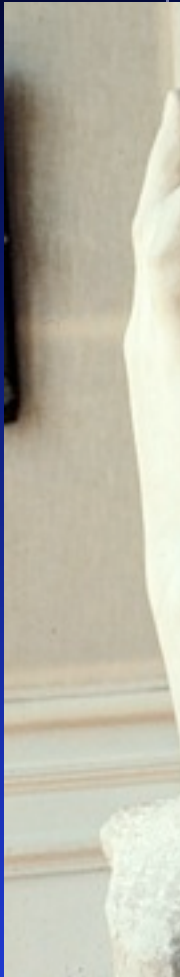


It is the
worst of
times....

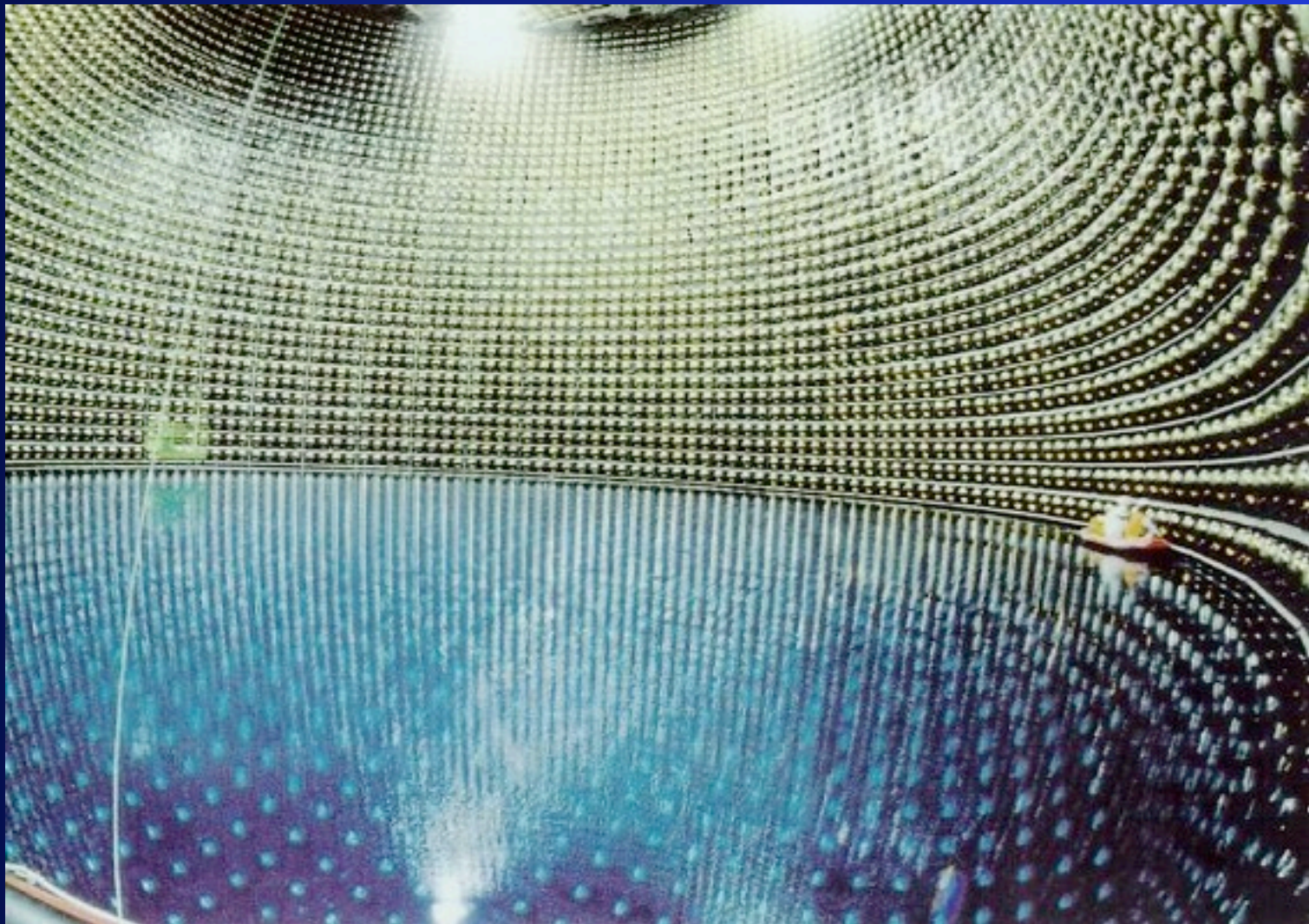




*“ As it was in the beginning, is now, and ever
shall be, world without end...”*









Q: Why do we live in a Universe of Matter???



In the beginning



In the beginning

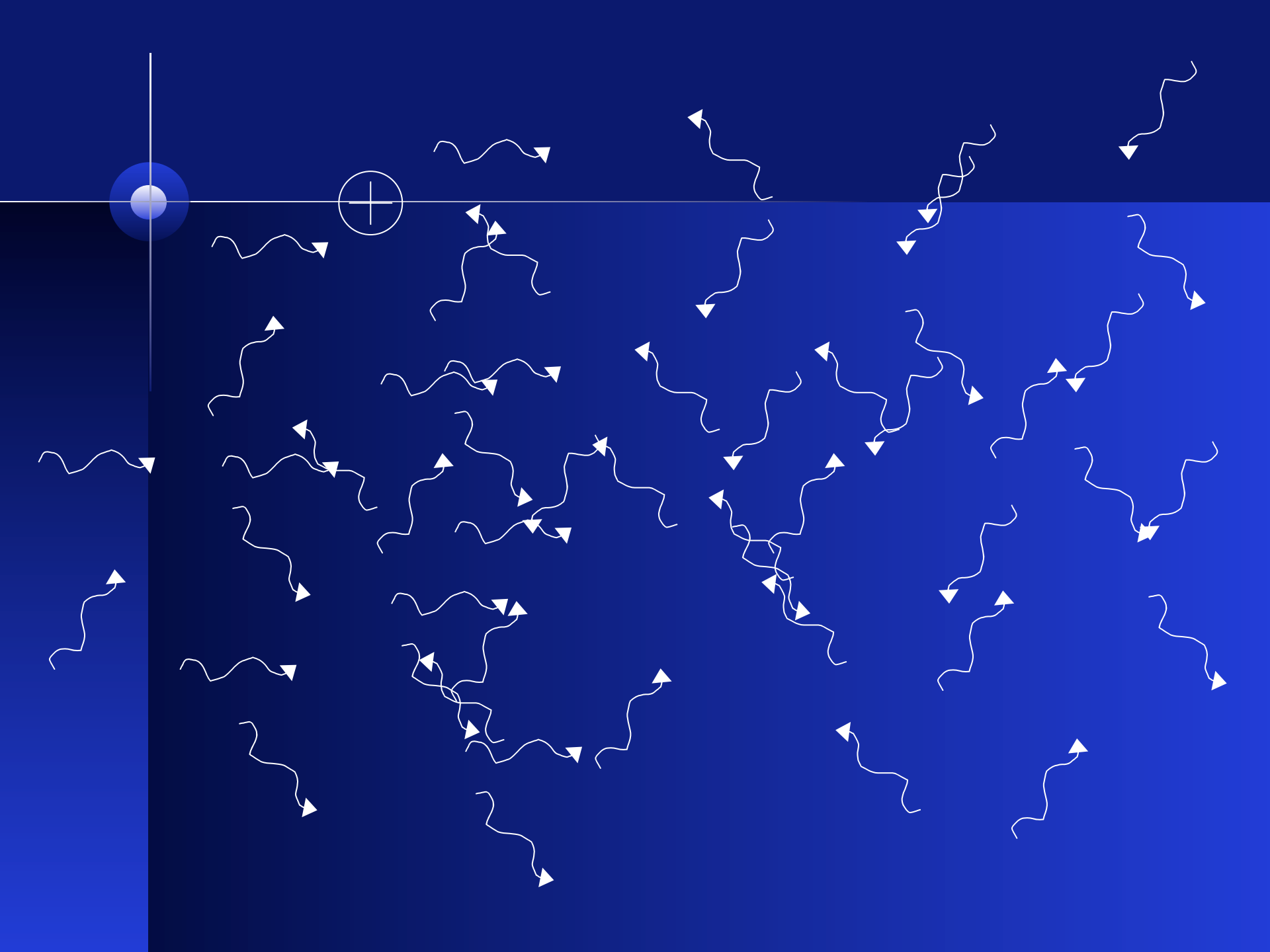
There were no Atoms...

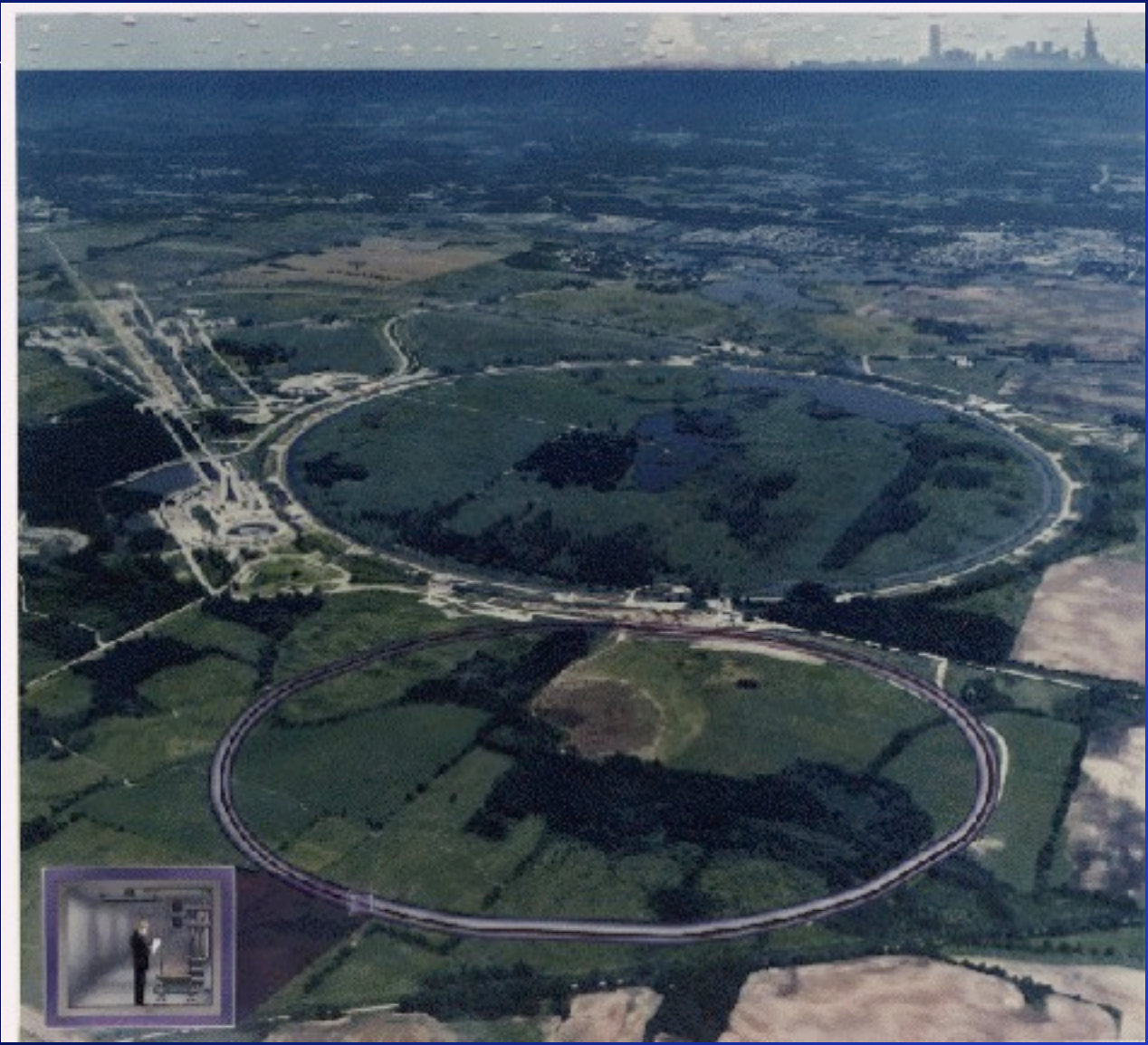


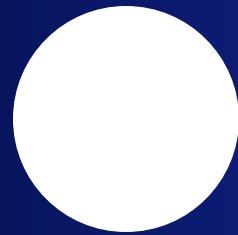
In the beginning

There were no Atoms... or Eves.

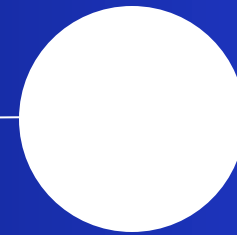








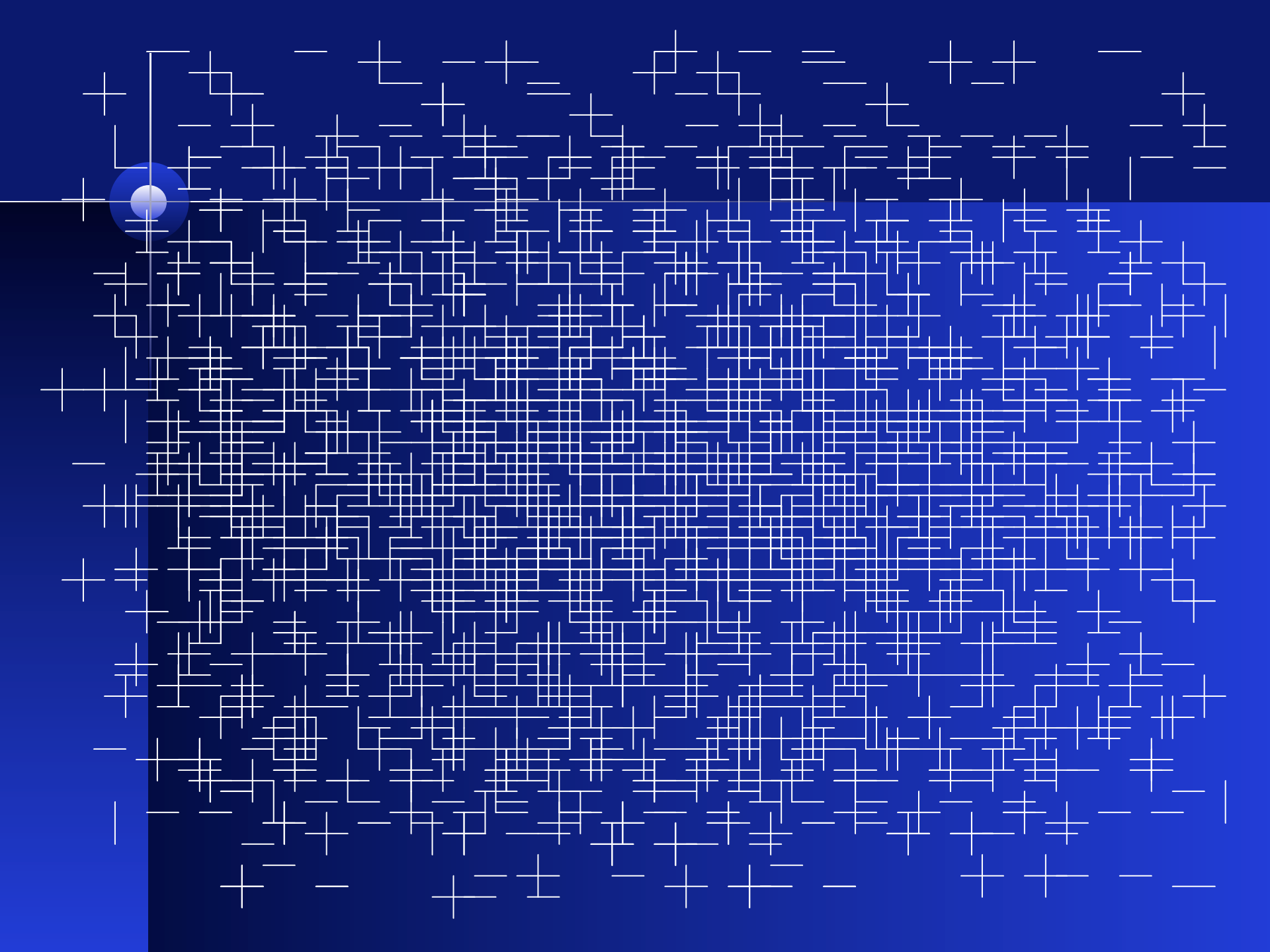
Particle (matter)



Antiparticle (antimatter)



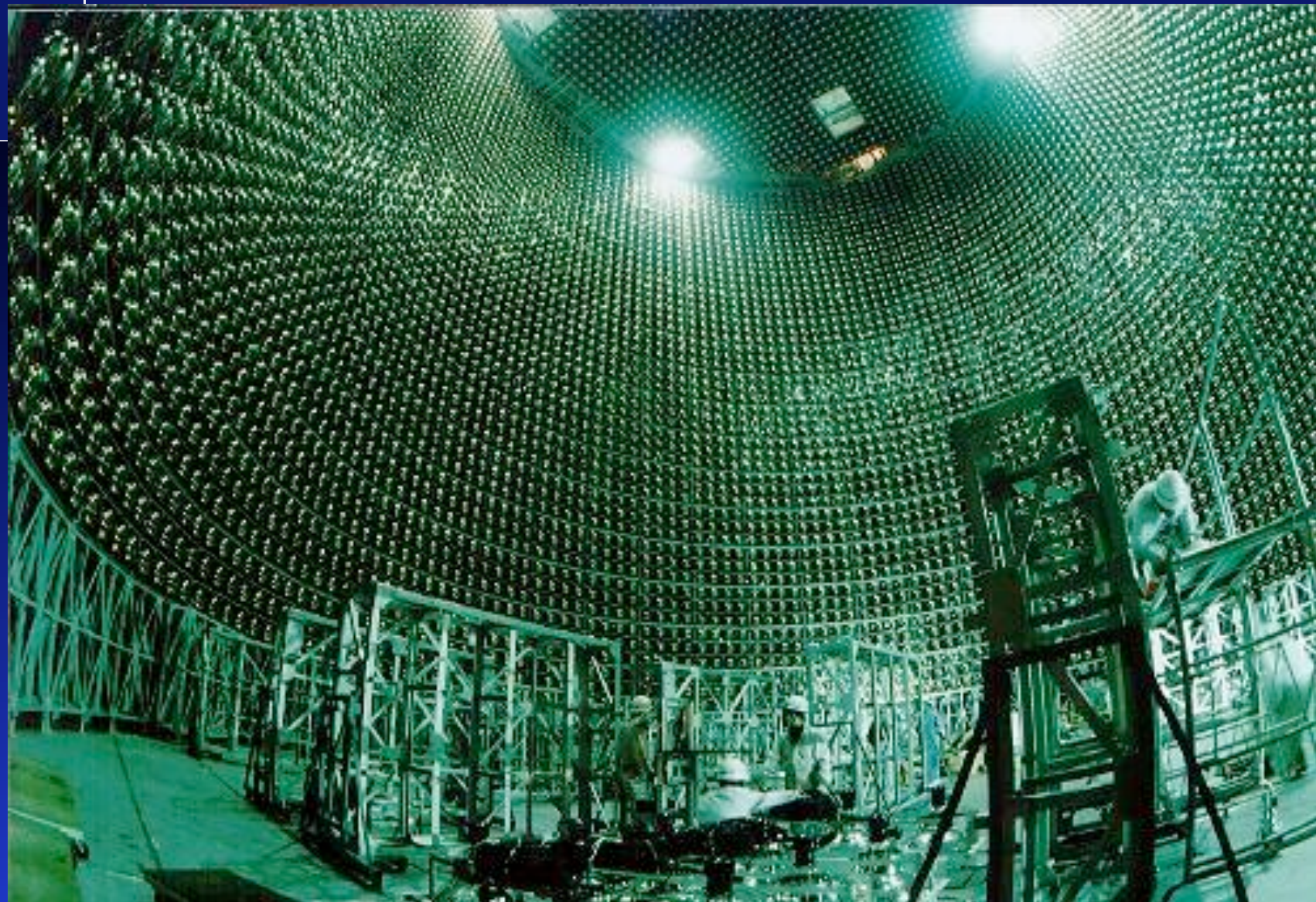




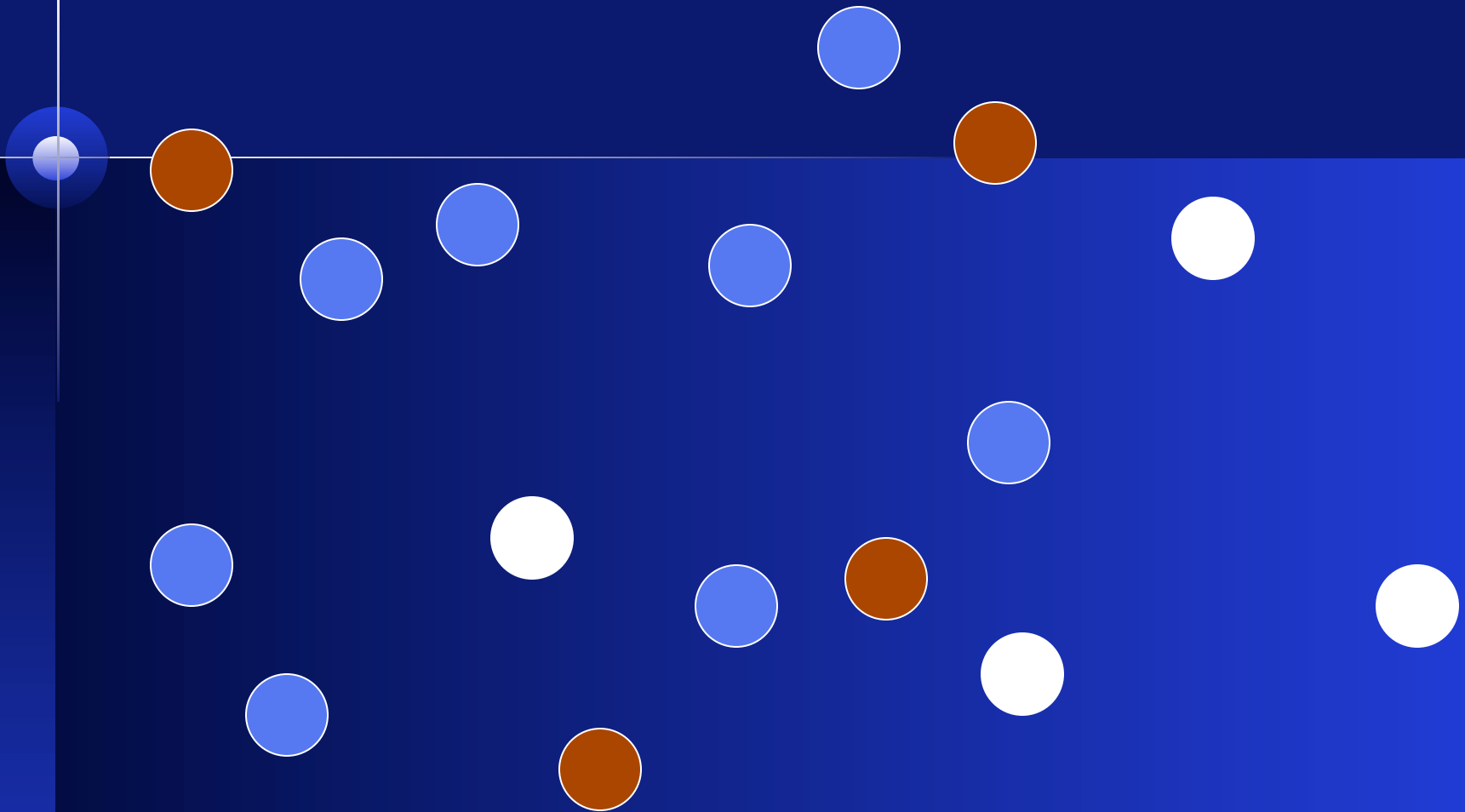
CREATION

**An “accident” at the
beginning of time...**

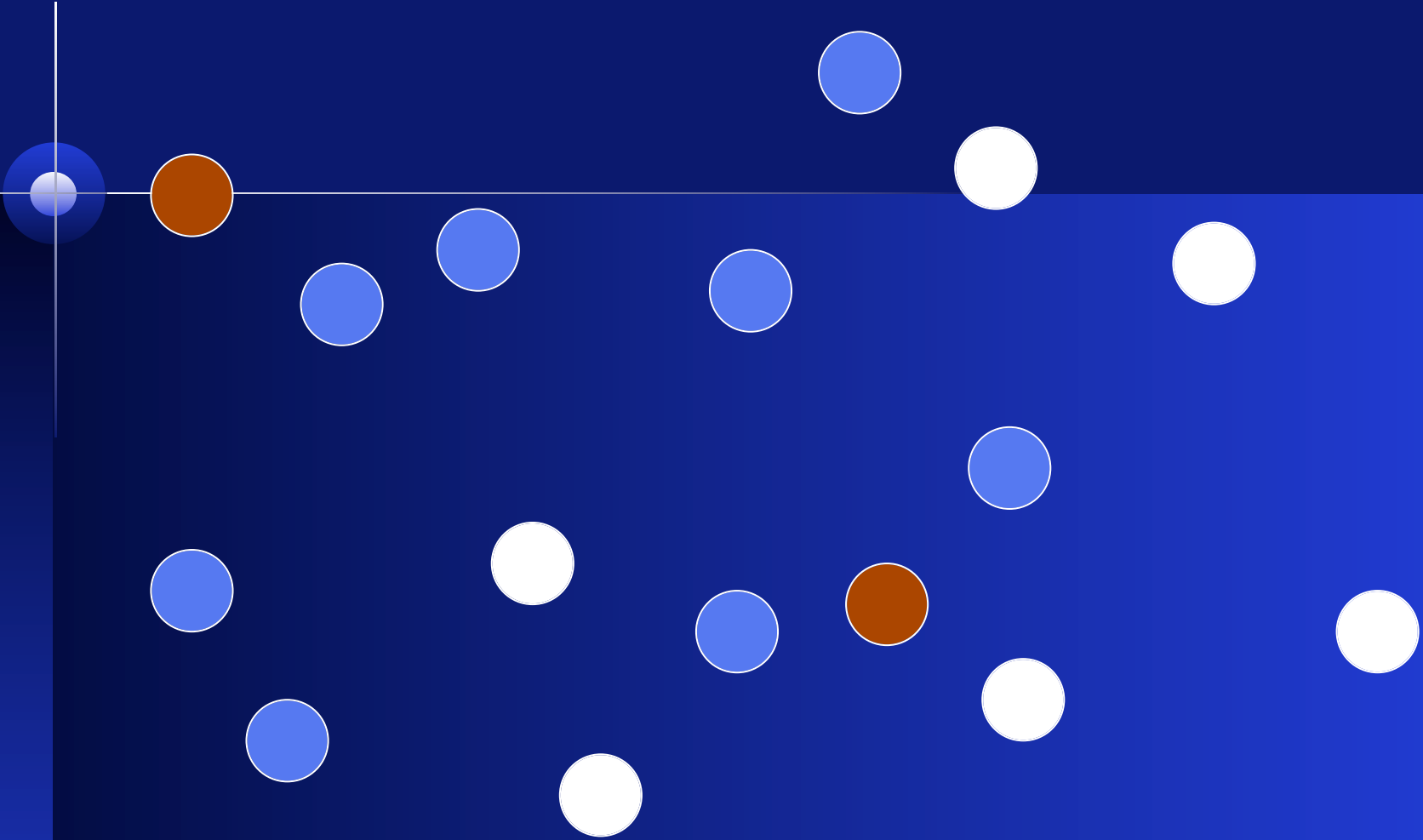
**So subtle, had anyone been
around at the time to notice,
no one would have...**



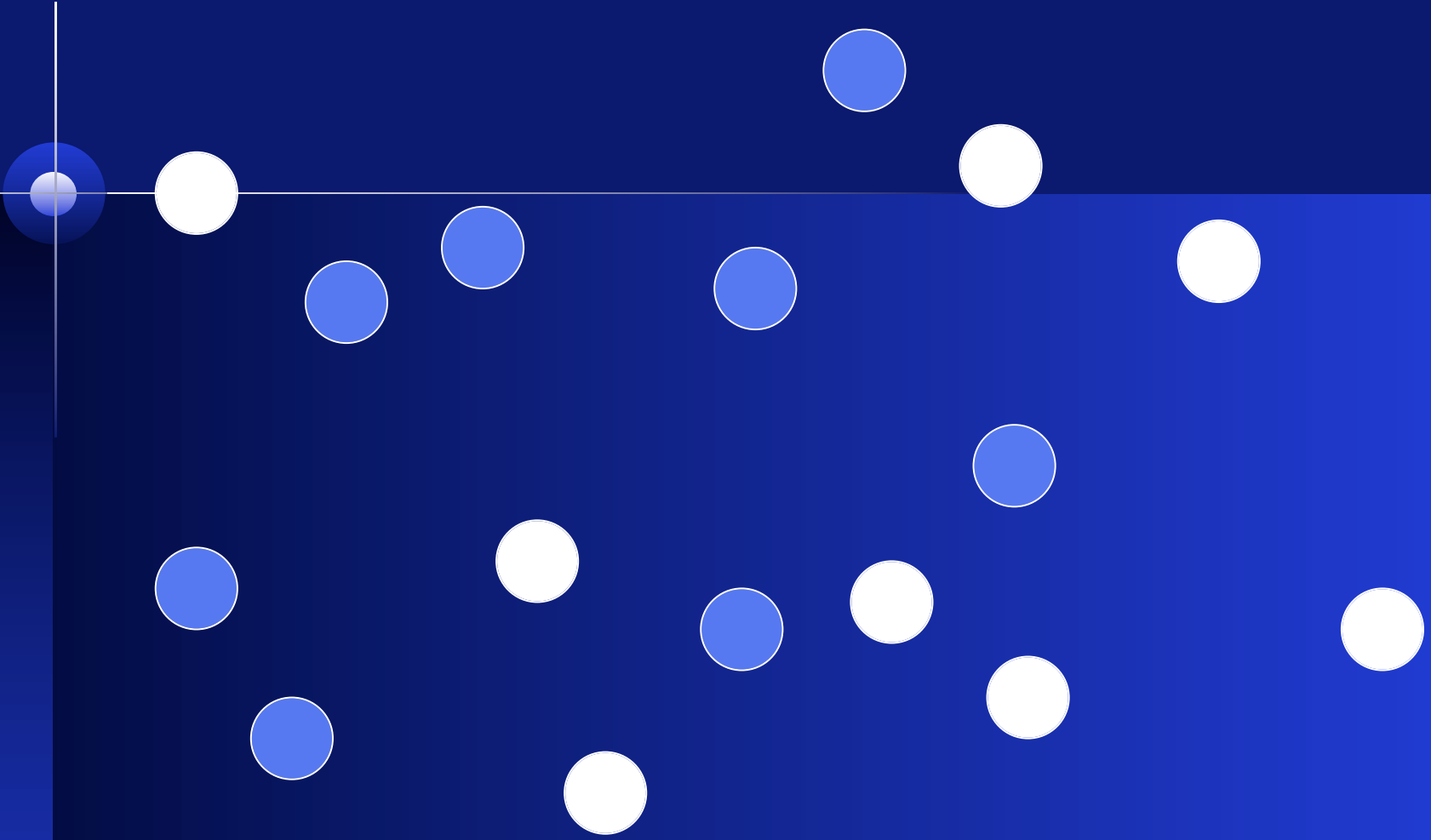
Another Cosmic Accident?.....



3 Second



3 Minute

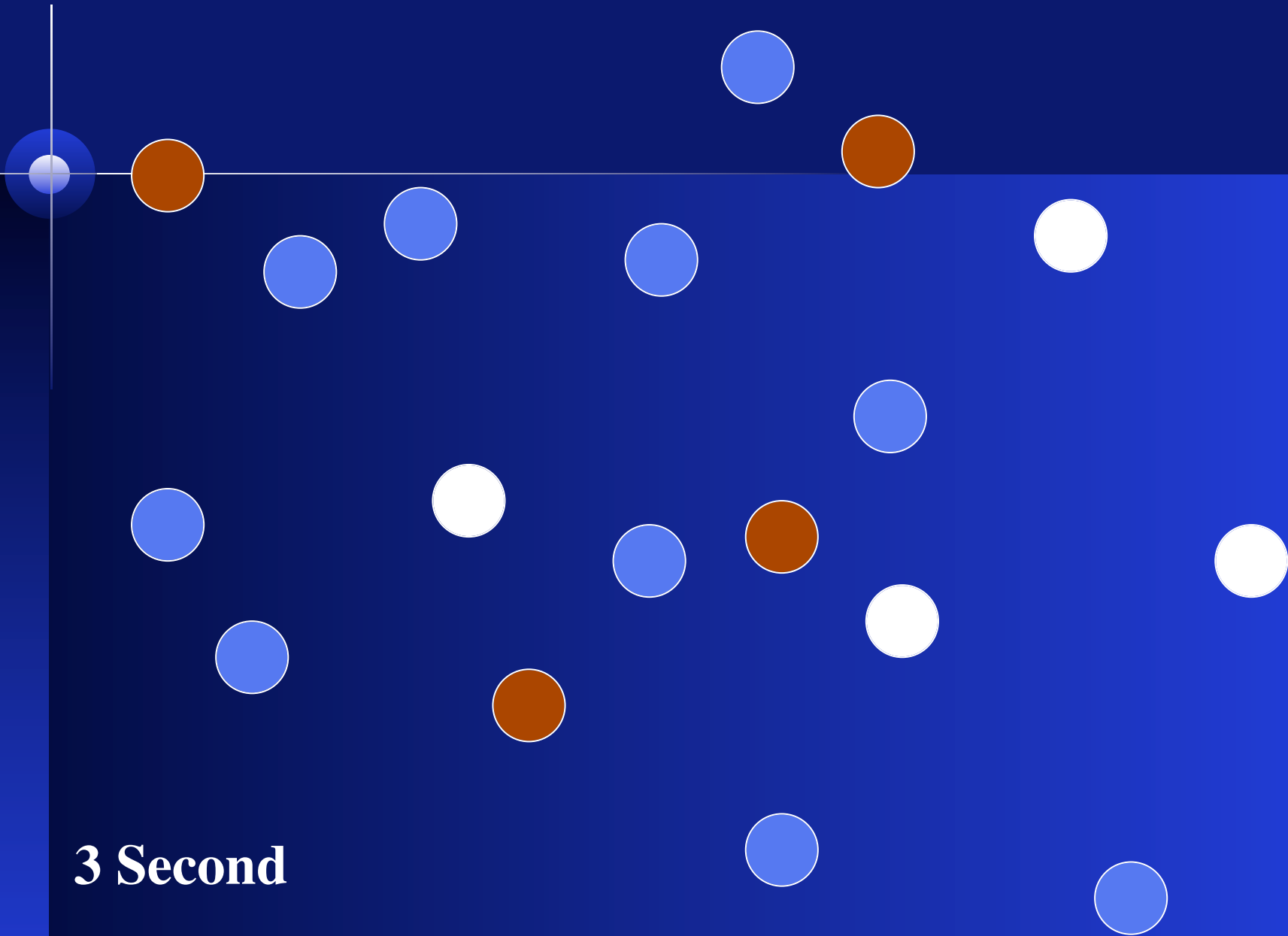


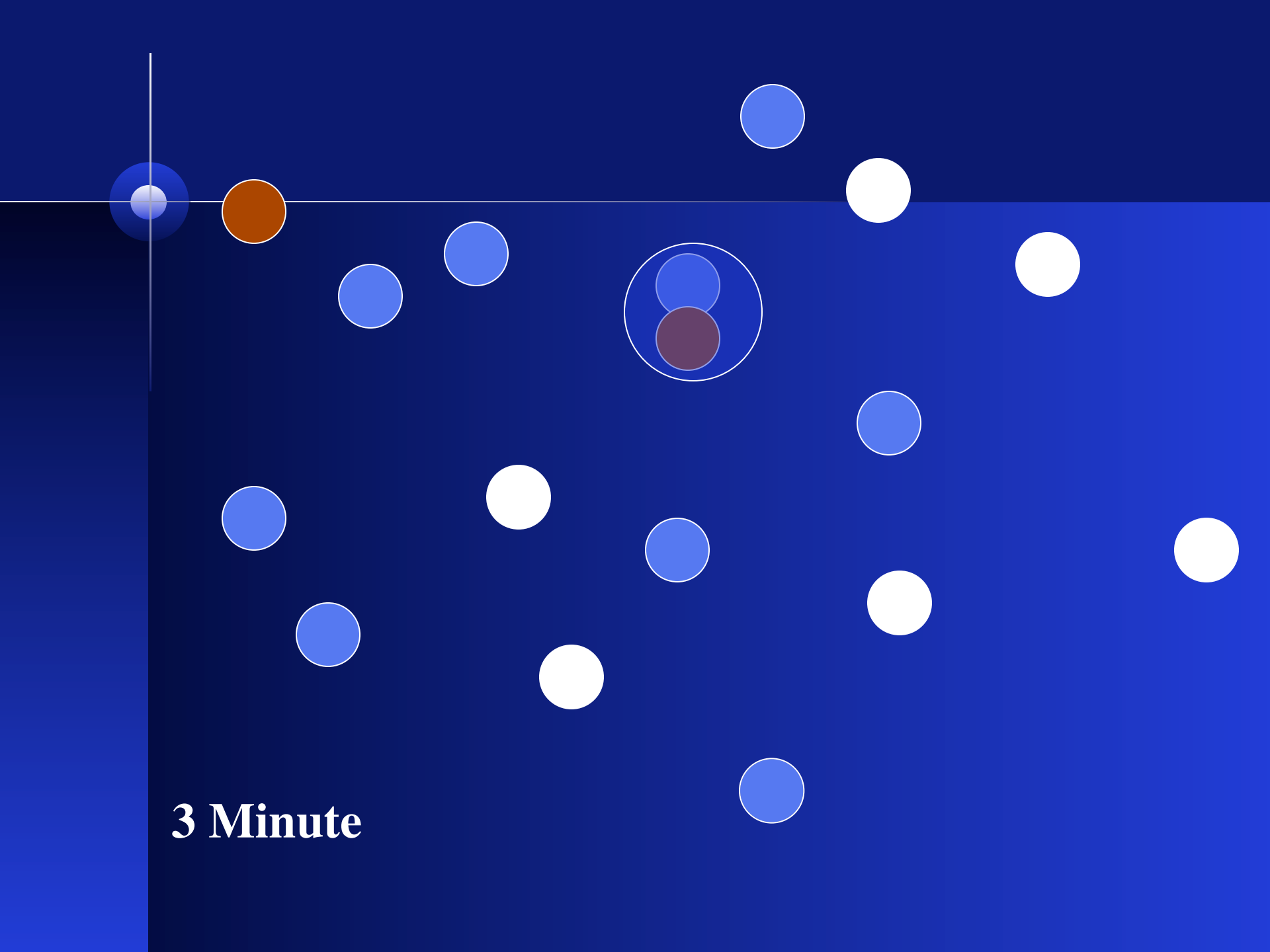
30 Minutes



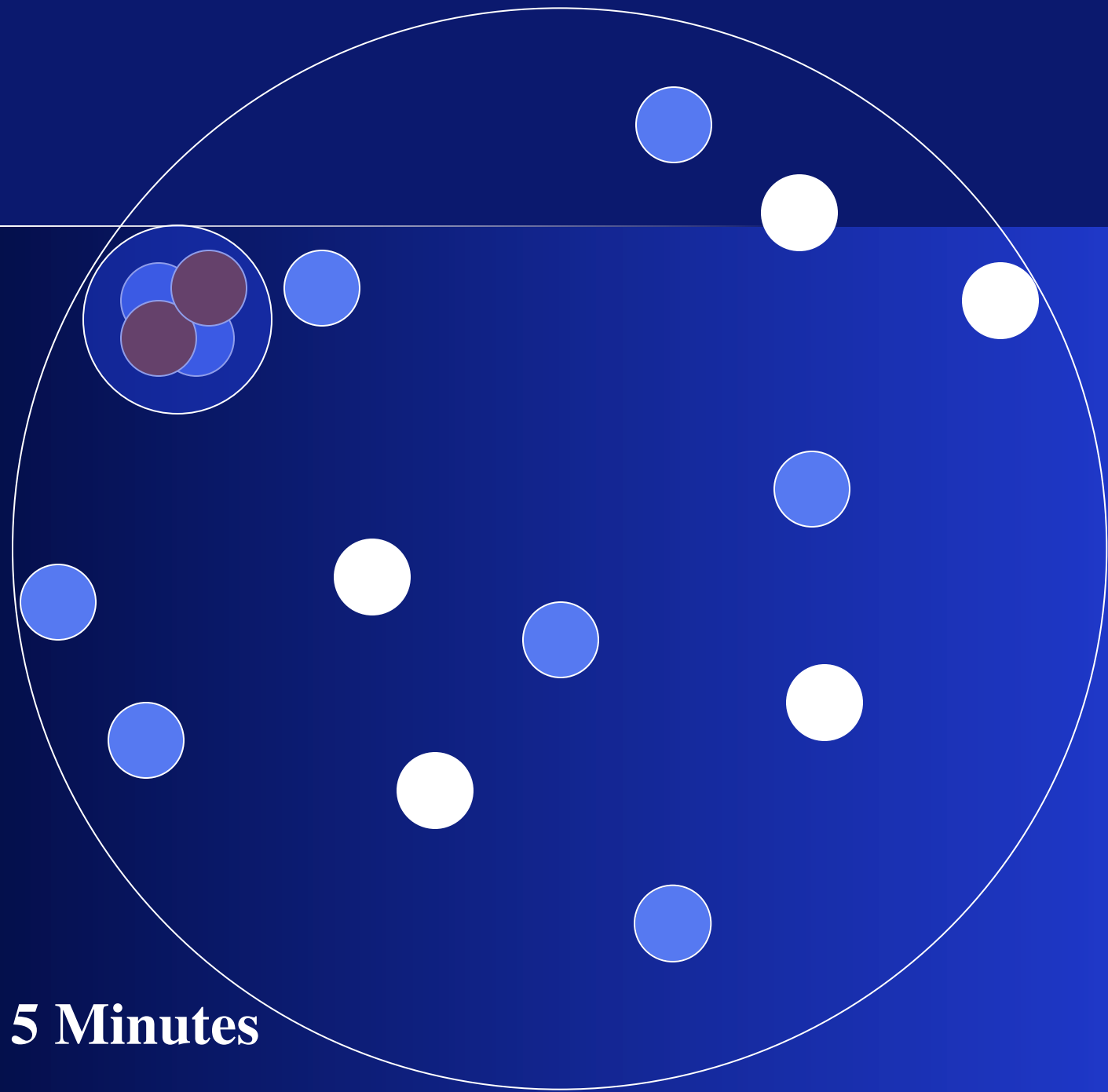
Mike

3 Second

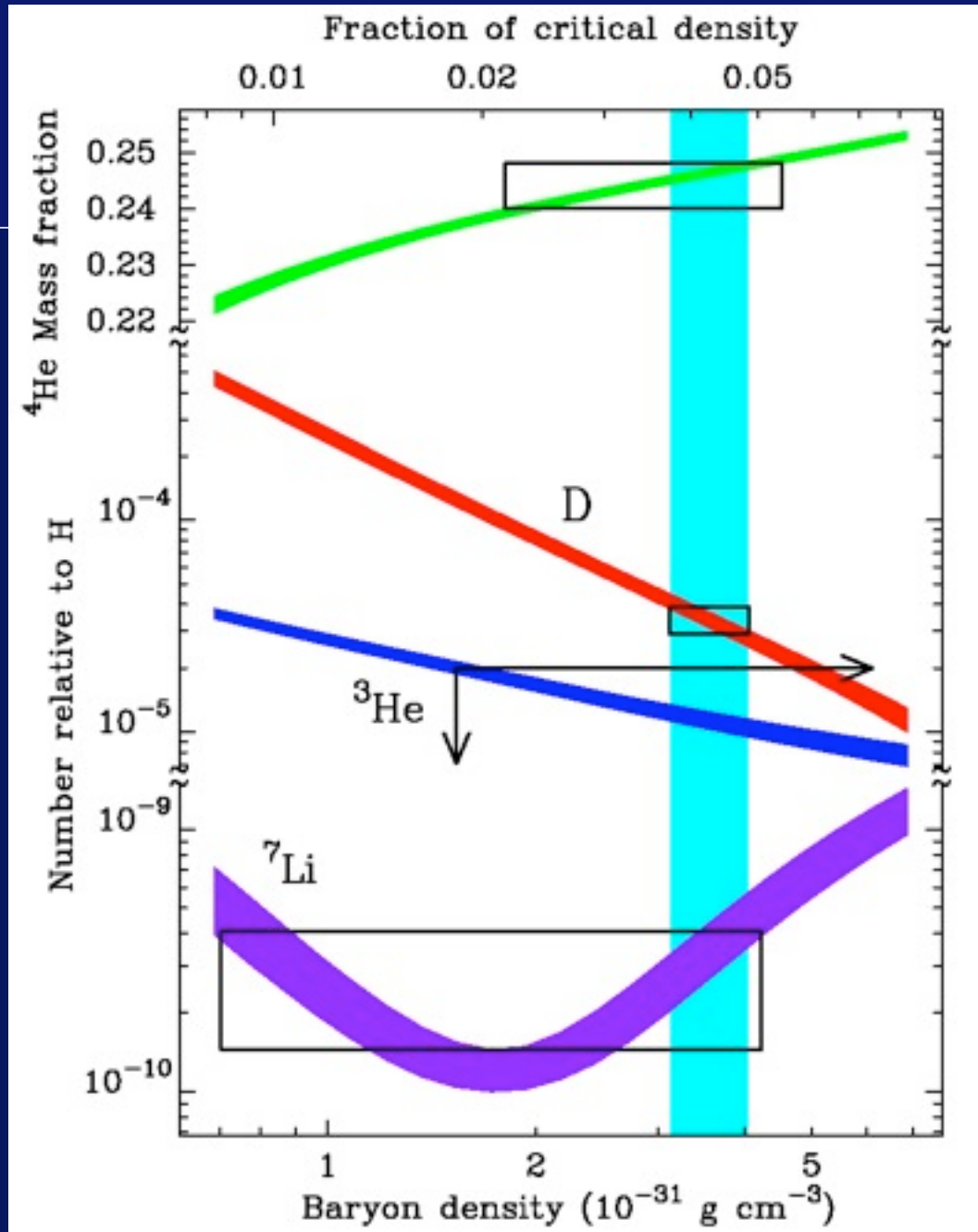




3 Minute



5 Minutes

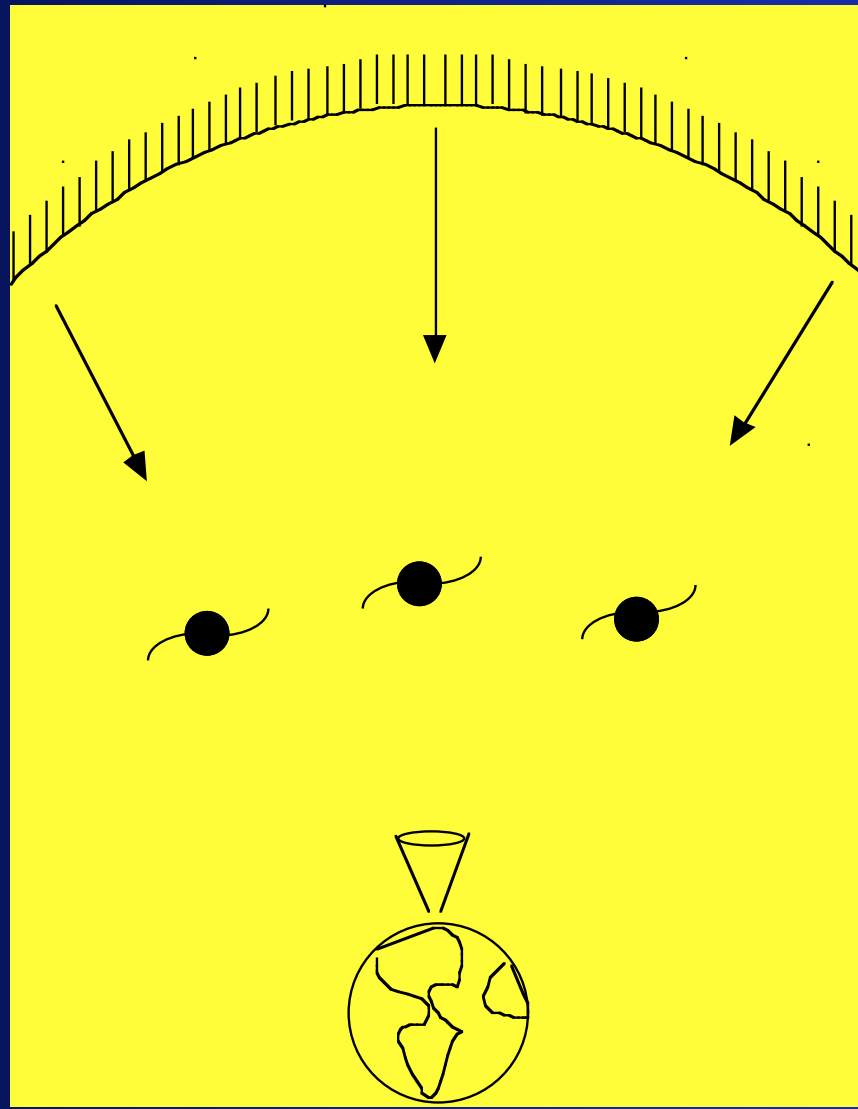


A Hundred Thousand Years of Solitude



A Hundred Thousand Years of Solitude

Last Scattering Surface: THE BIRTH OF ATOMS!



$t=10^5$ yrs

$T=3000$
K

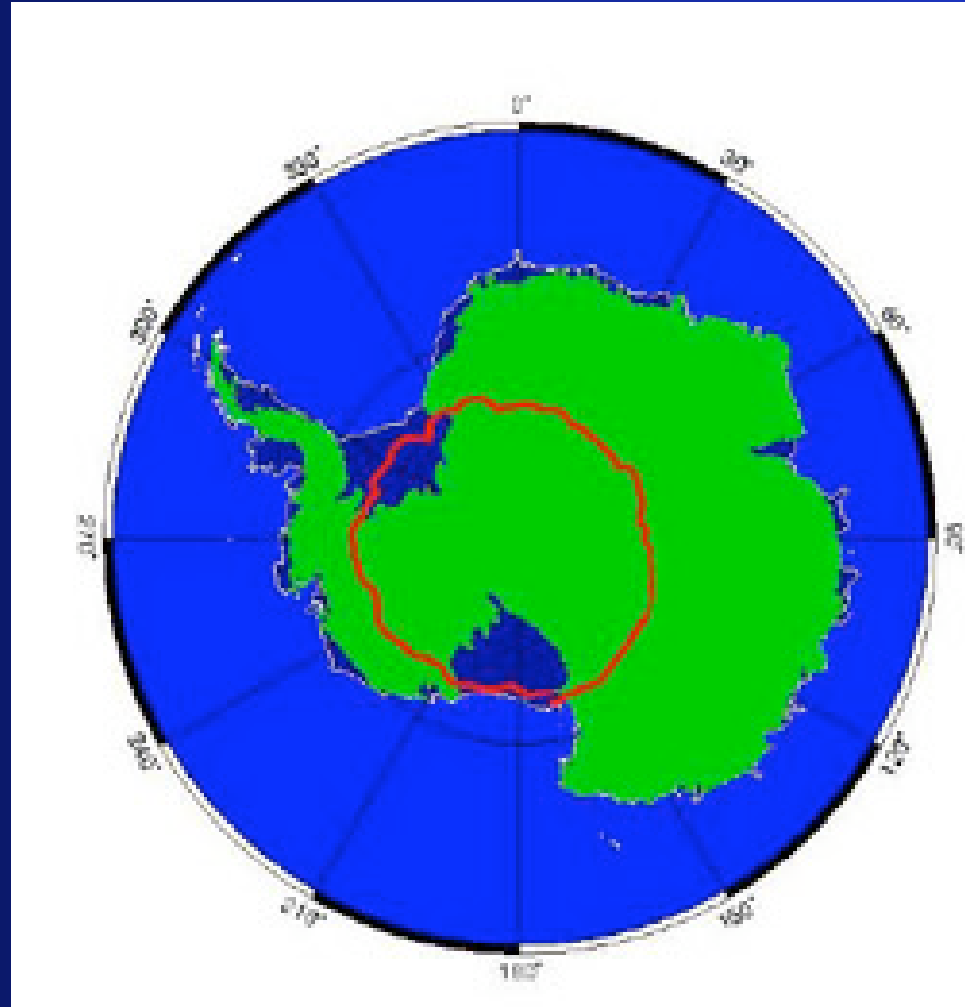
$t=10^9$ yrs

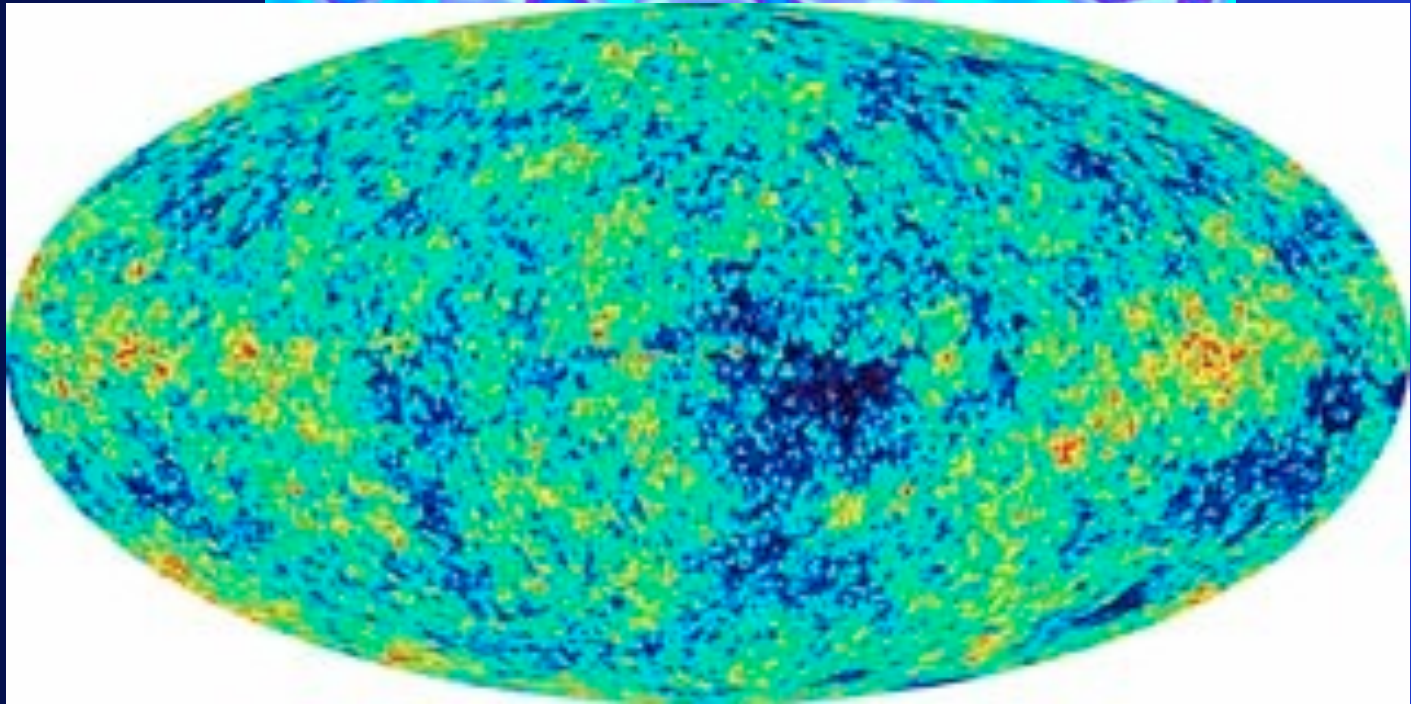
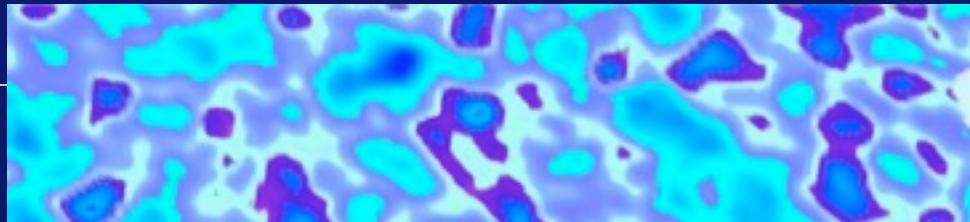
$T=10$ K

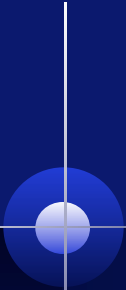
$t=10^{10}$ yrs

$T=2.735$ K









The ETERNAL war between gravity and pressure begins here....and will govern all that will follow...

Gravity will eventually win....



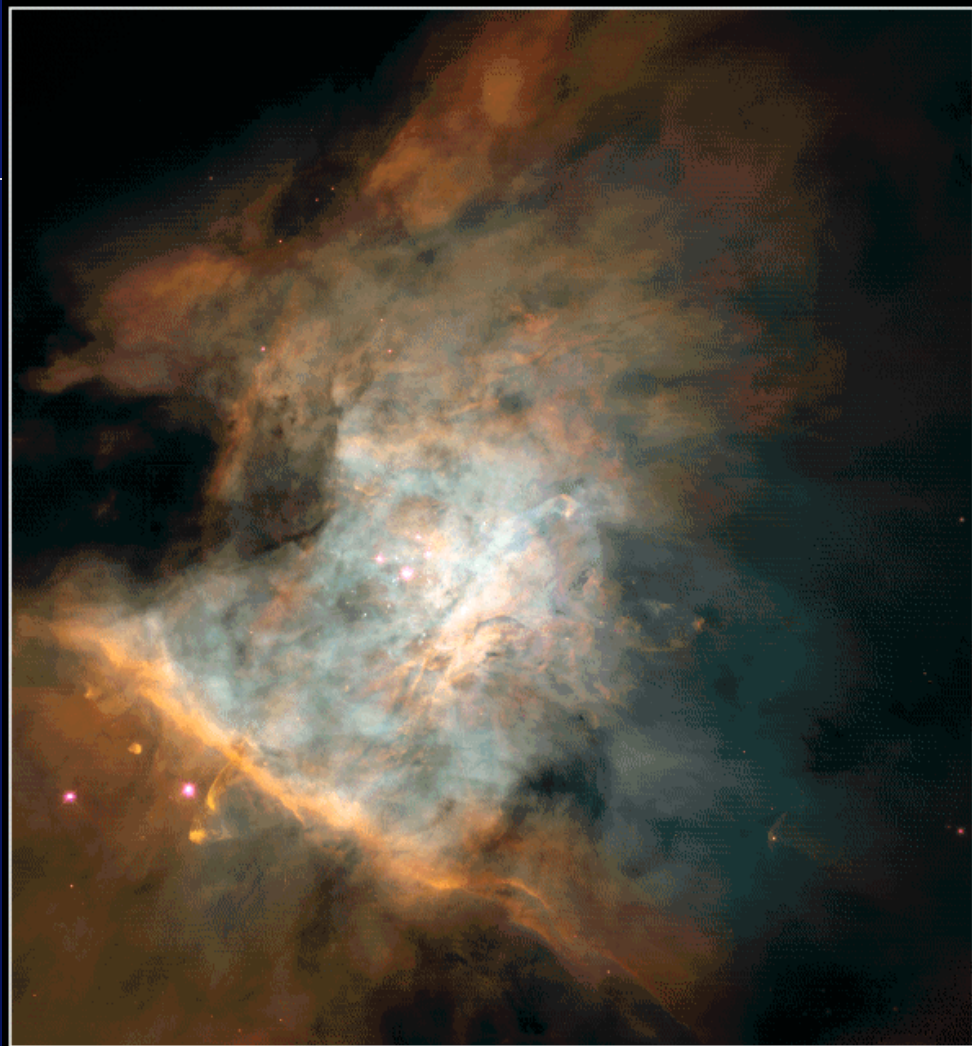




Star-Birth Clouds - M16

HST - WFPC2

PRC95-44b - ST ScI OPC - November 2, 1995
J. Hester and P. Bowden (AZ State Univ.), NASA

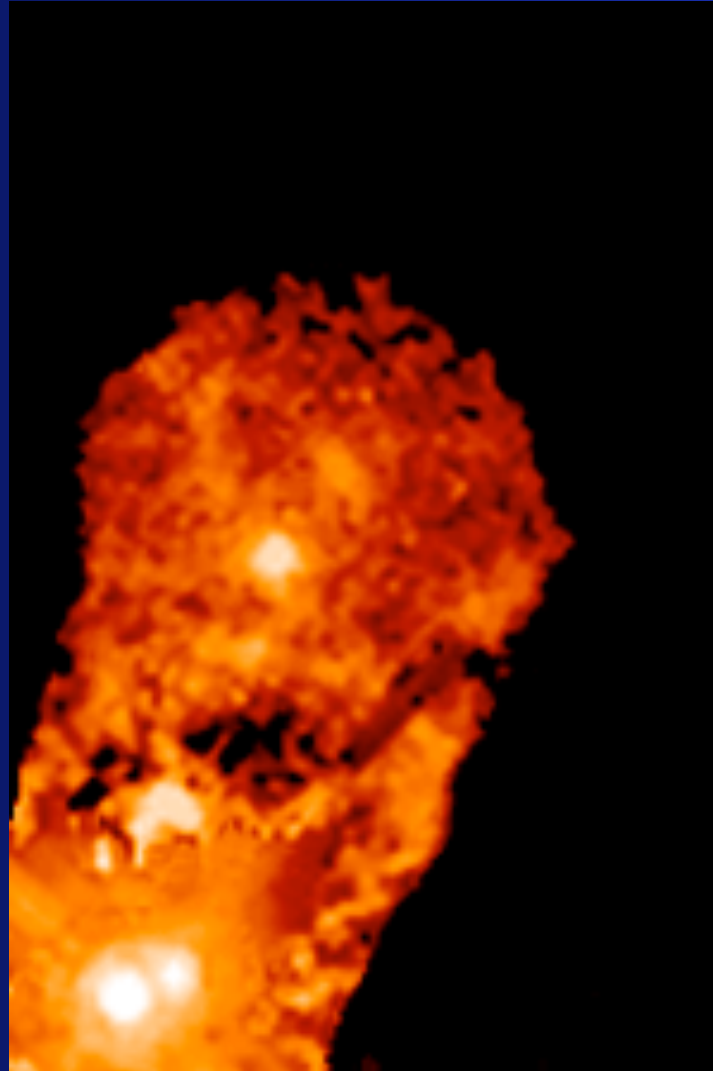


Orion Nebula Mosaic

HST • WFPC2

PRC95-45a • ST ScI OPO • November 20, 1995

C. R. O'Dell and S. K. Wong (Rice University), NASA





Primordial gas cloud
77% hydrogen
23% helium
(by mass)

Hydrogen burning
Core temperature = 4×10^7 K
Core density = 7 g/cm^3

Helium burning
Core temperature = 1.6×10^8 K
Core density = $1,500 \text{ g/cm}^3$

10 to 15 million years

1 million years

End of silicon burning
(Enlarged view)

Carbon burning
100,000 years

Neon burning
<1 year

Oxygen burning
10,000 years

Hydrogen $\sim 23,000,000$ km

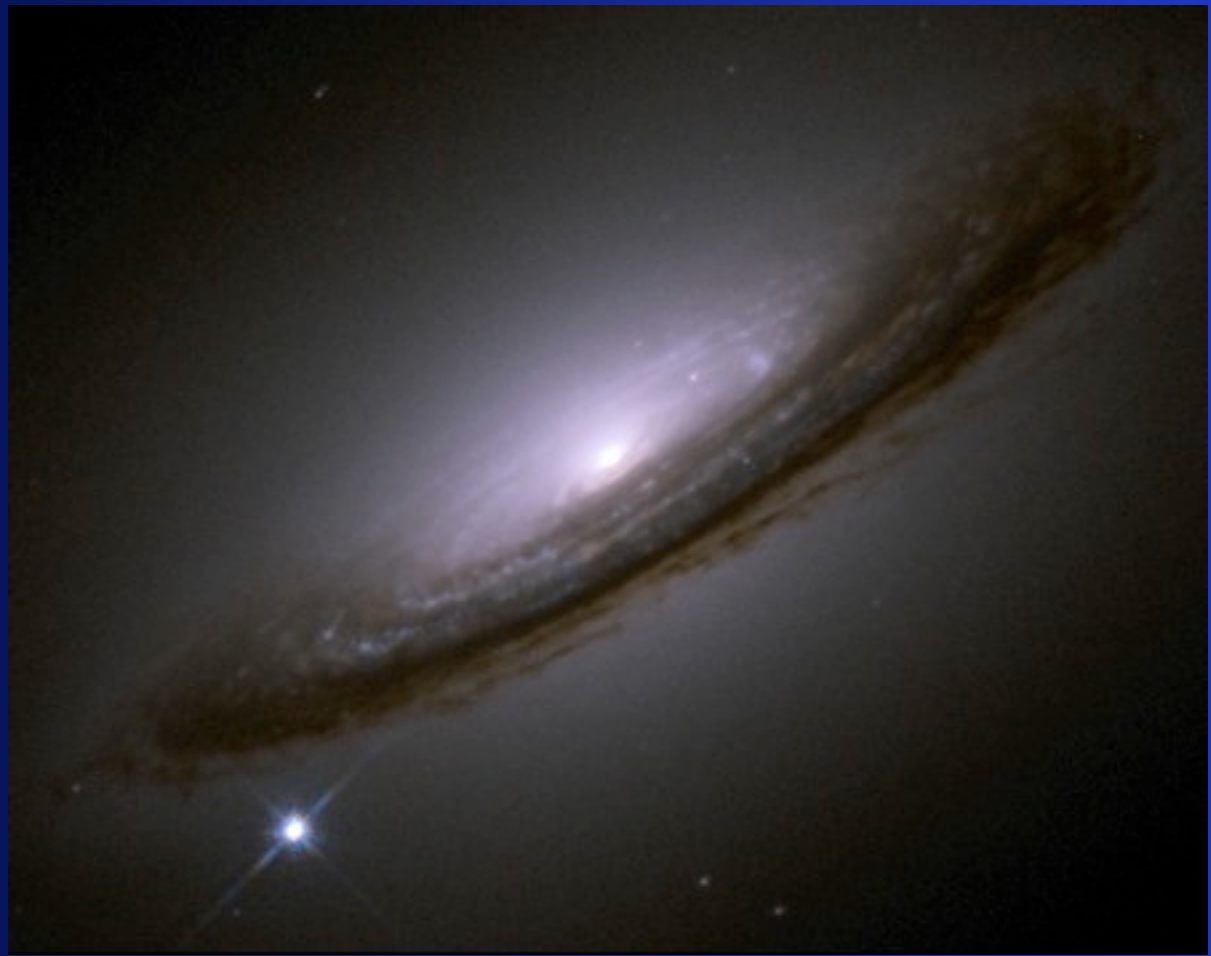
Helium $\sim 500,000$ km

Carbon, oxygen, neon $\sim 36,000$ km

The core
Silicon $\sim 4,000$ km
Iron ~ 850 km
Central temperature $> 10^9$ K
Average density $\sim 10^7 \text{ g/cm}^3$

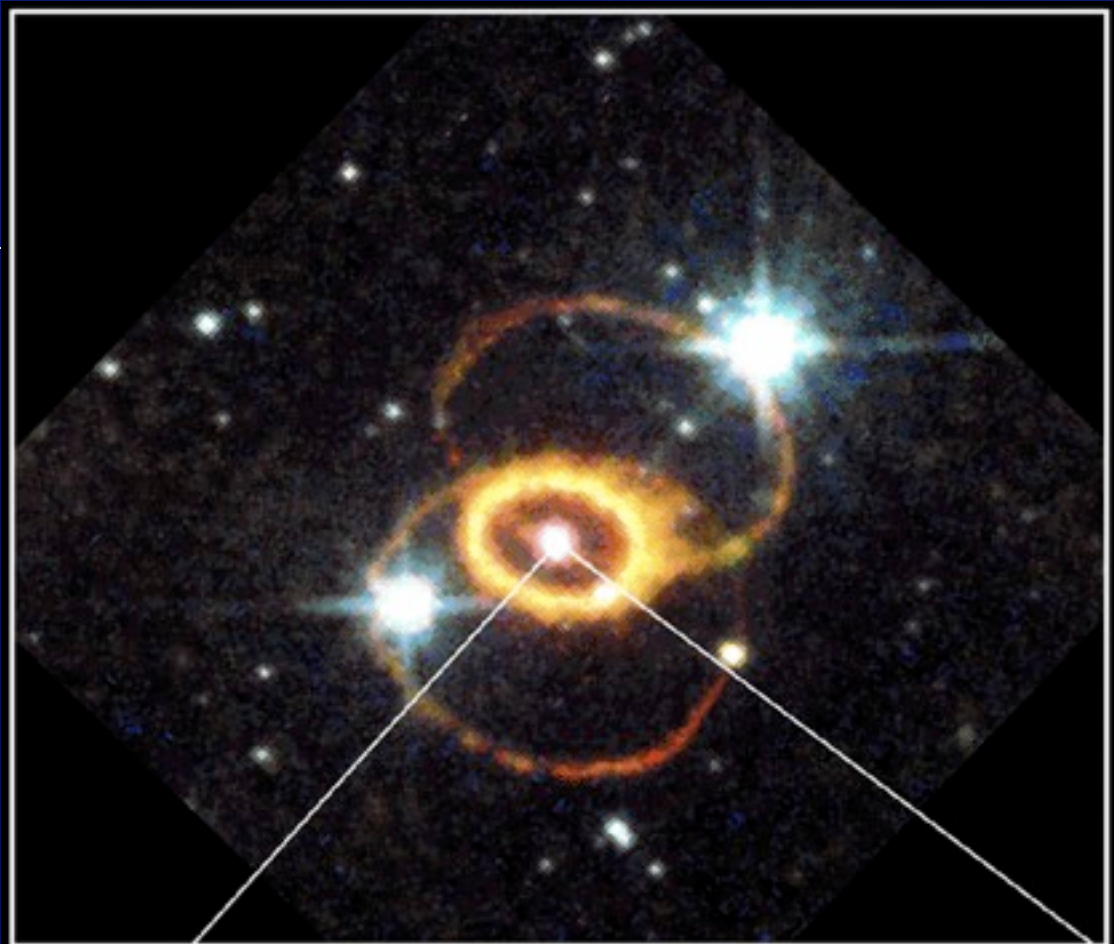










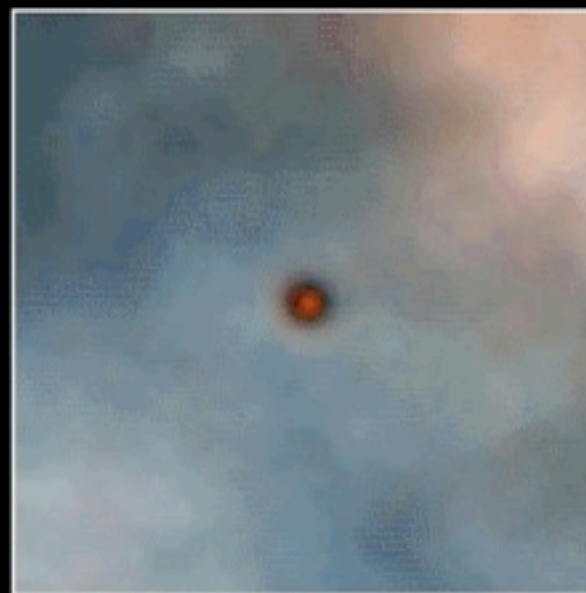


Supernova 1987A

HST . WFPC2

PRC97-03 • ST ScI OPO • January 14, 1997
J. Pun (NASA/GSFC), R. Kirshner (CfA) and NASA



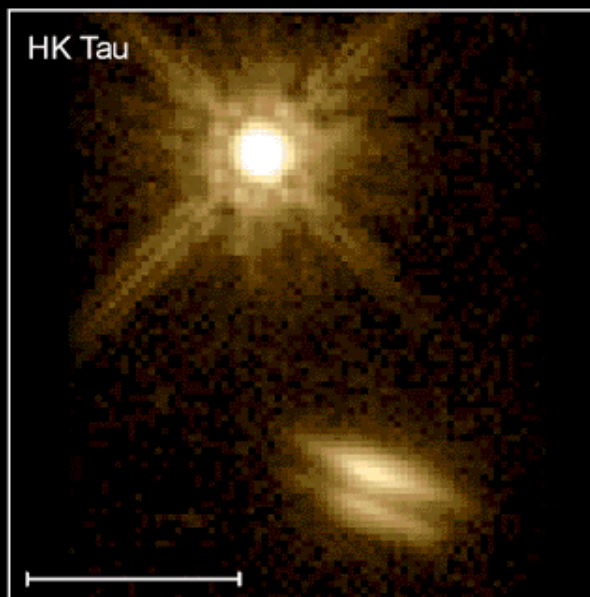
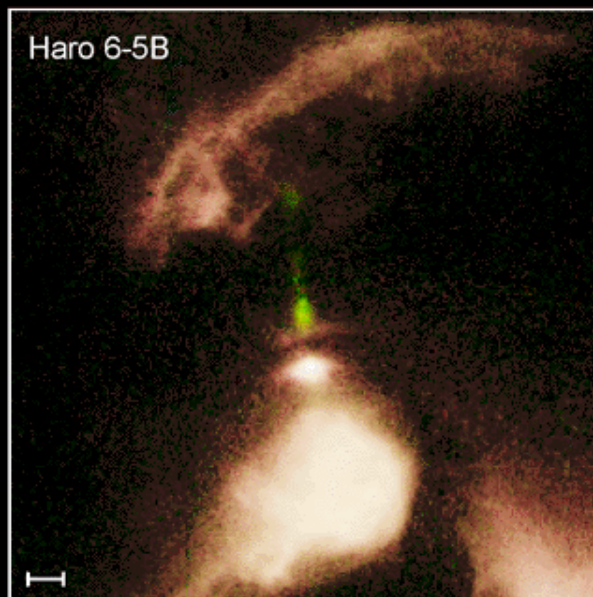
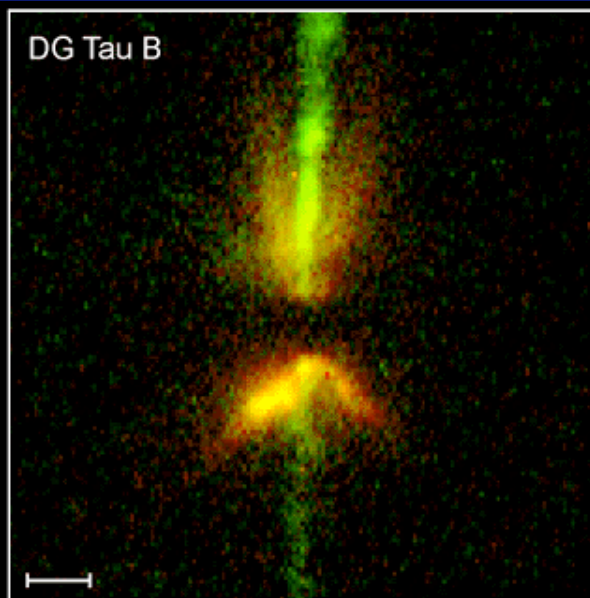
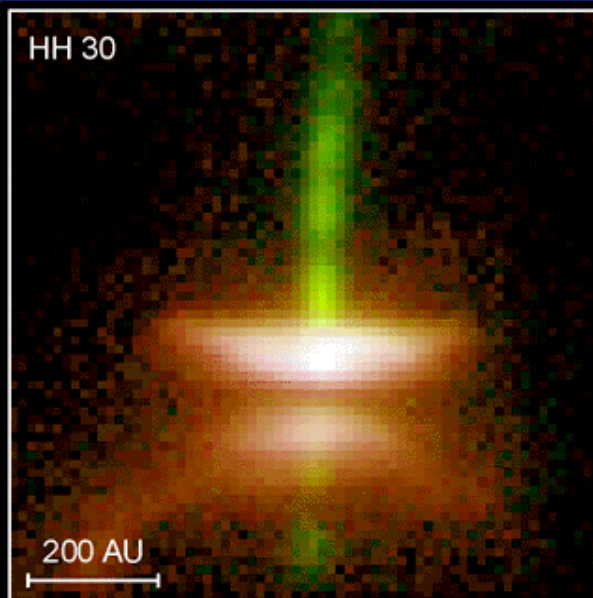


**Protoplanetary Disks
Orion Nebula**

HST · WFPC2

PRC95-45b · ST ScI OPO · November 20, 1995

M. J. McCaughrean (MPIA), C. R. O'Dell (Rice University), NASA

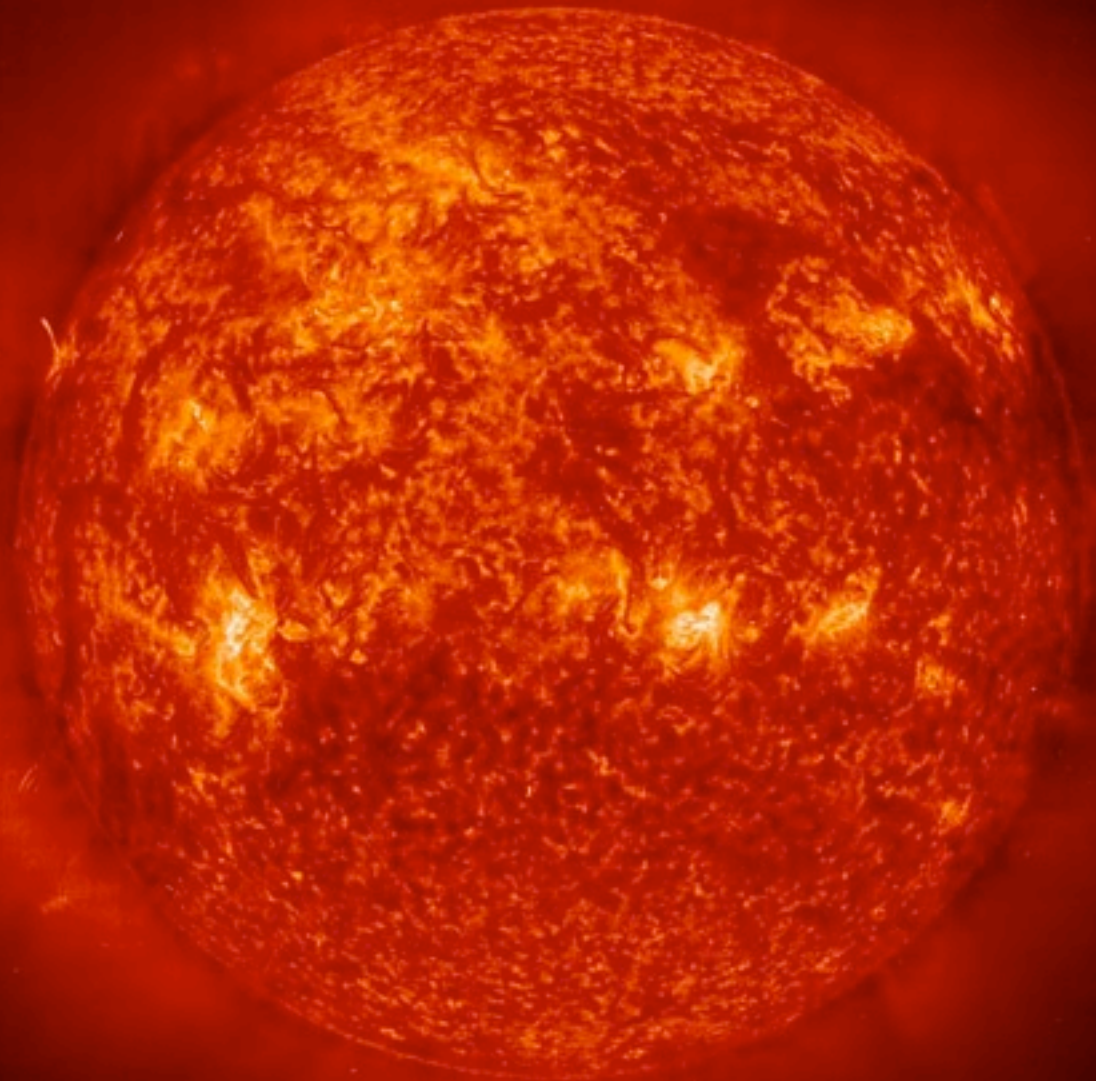
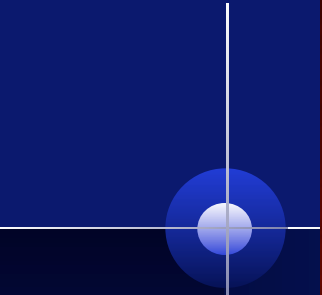


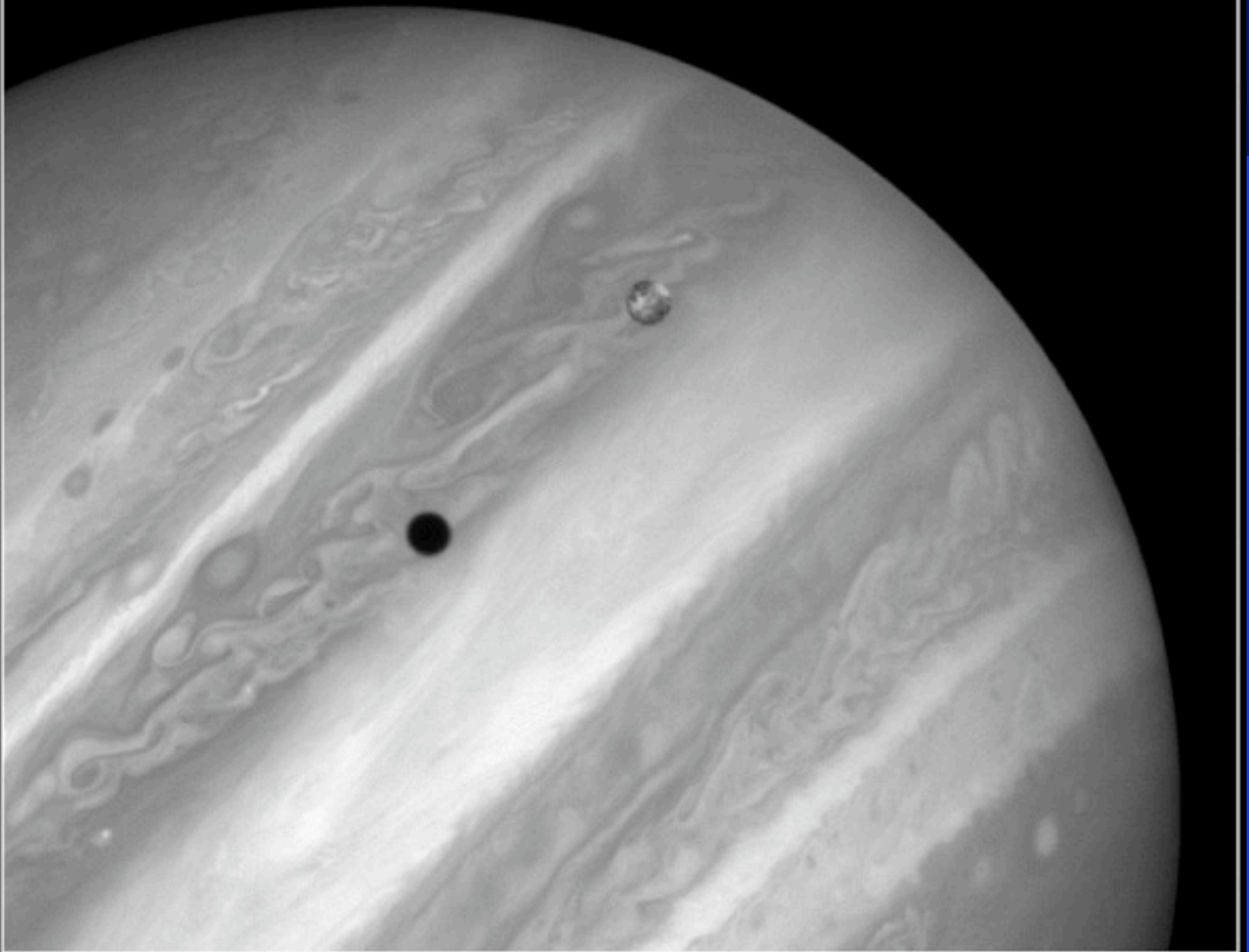
Disks around Young Stars

HST • WFPC2

PRC99-05b • STScI OPO

C. Burrows and J. Krist (STScI), K. Stapelfeldt (JPL) and NASA





Jupiter and Io

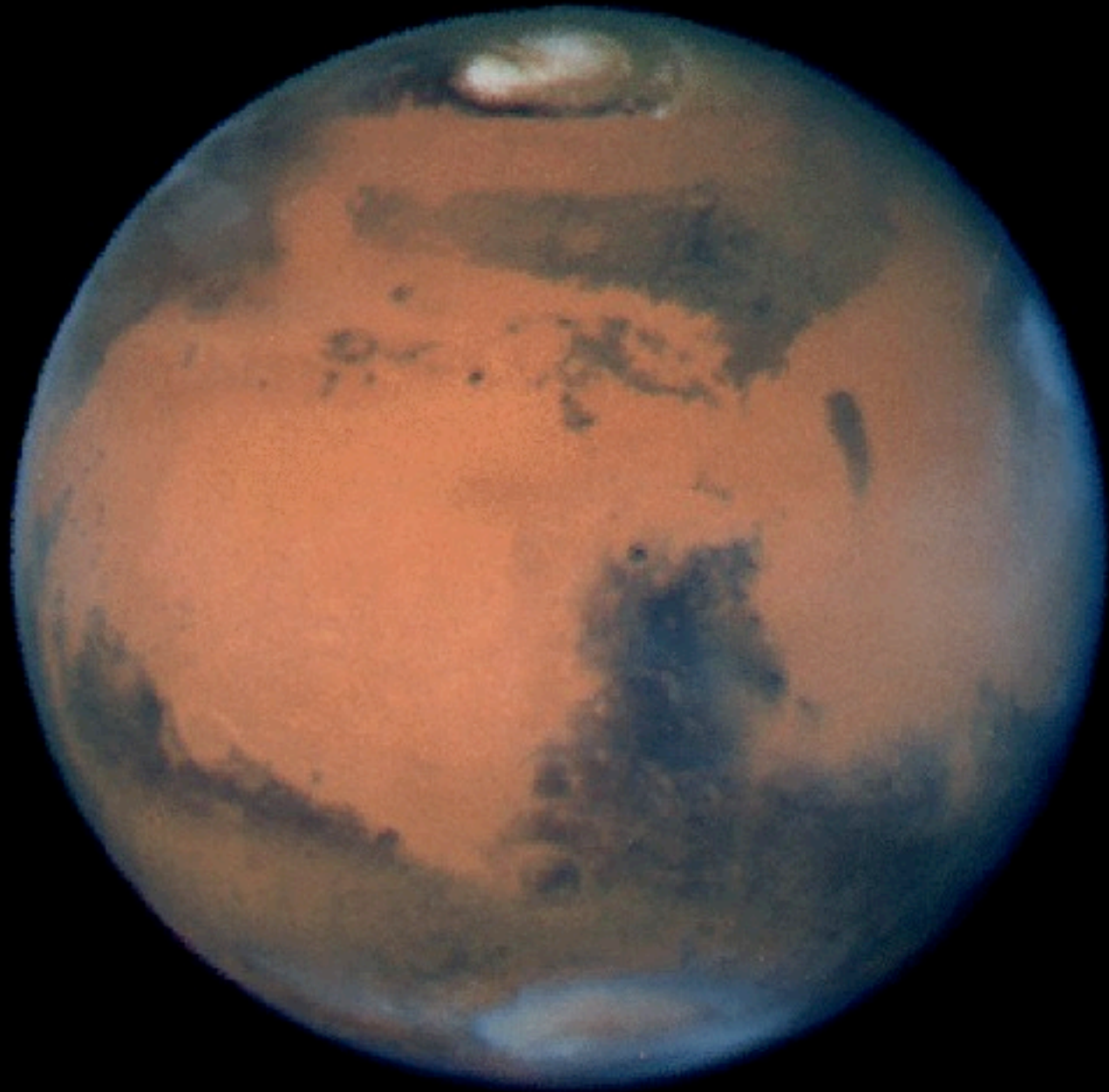
HST · WFPC2

PRC96-30 · ST ScI OPO · October 4, 1996 · J. Spencer (Lowell Observatory) and NASA





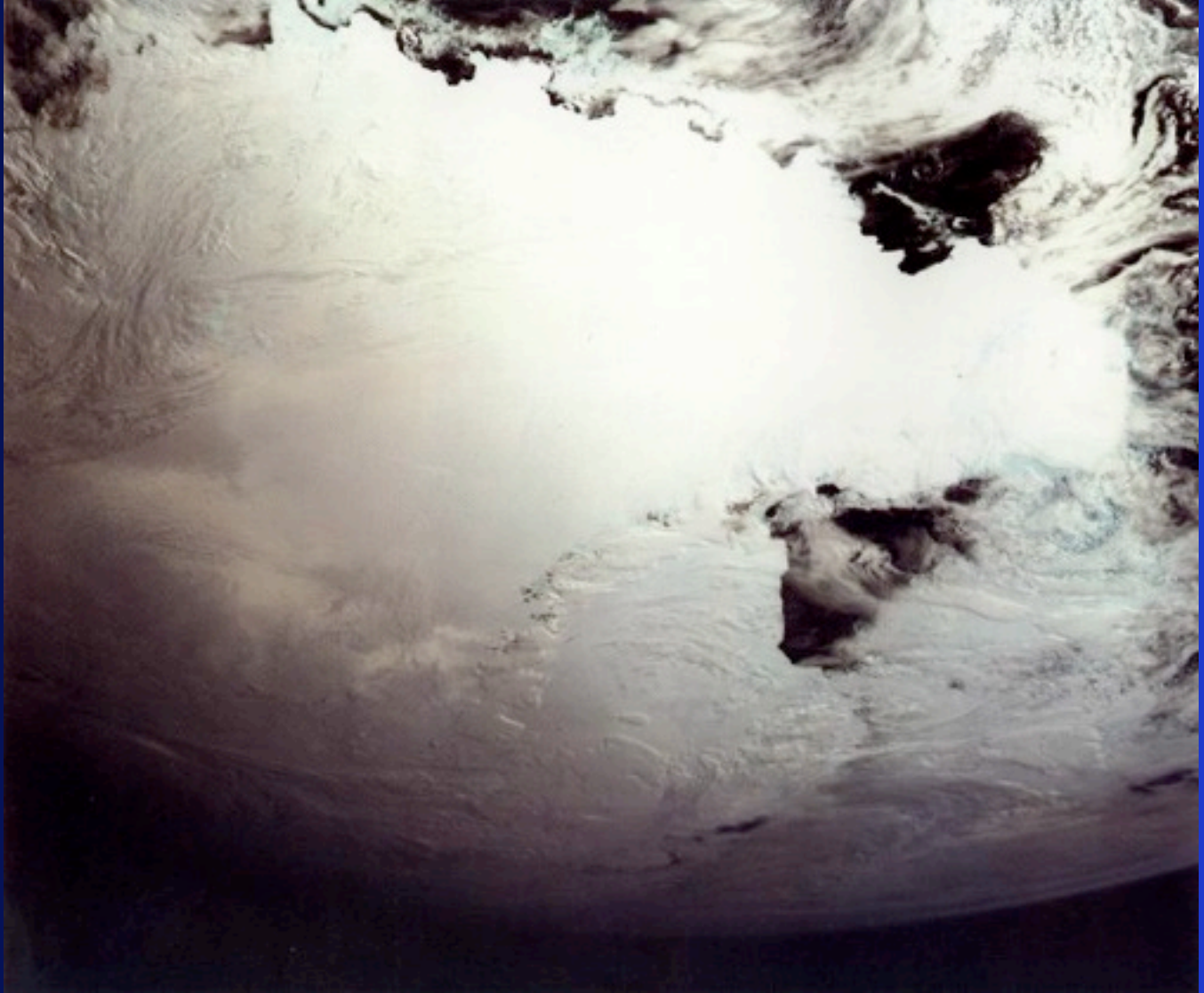




Mars • Syrtis Major • March 10, 1997

HST • WFPC2

PRC97-09a • ST Sci OPO • March 24, 1997 • D. Crisp (JPL), the WFPC2 Science Team and NASA





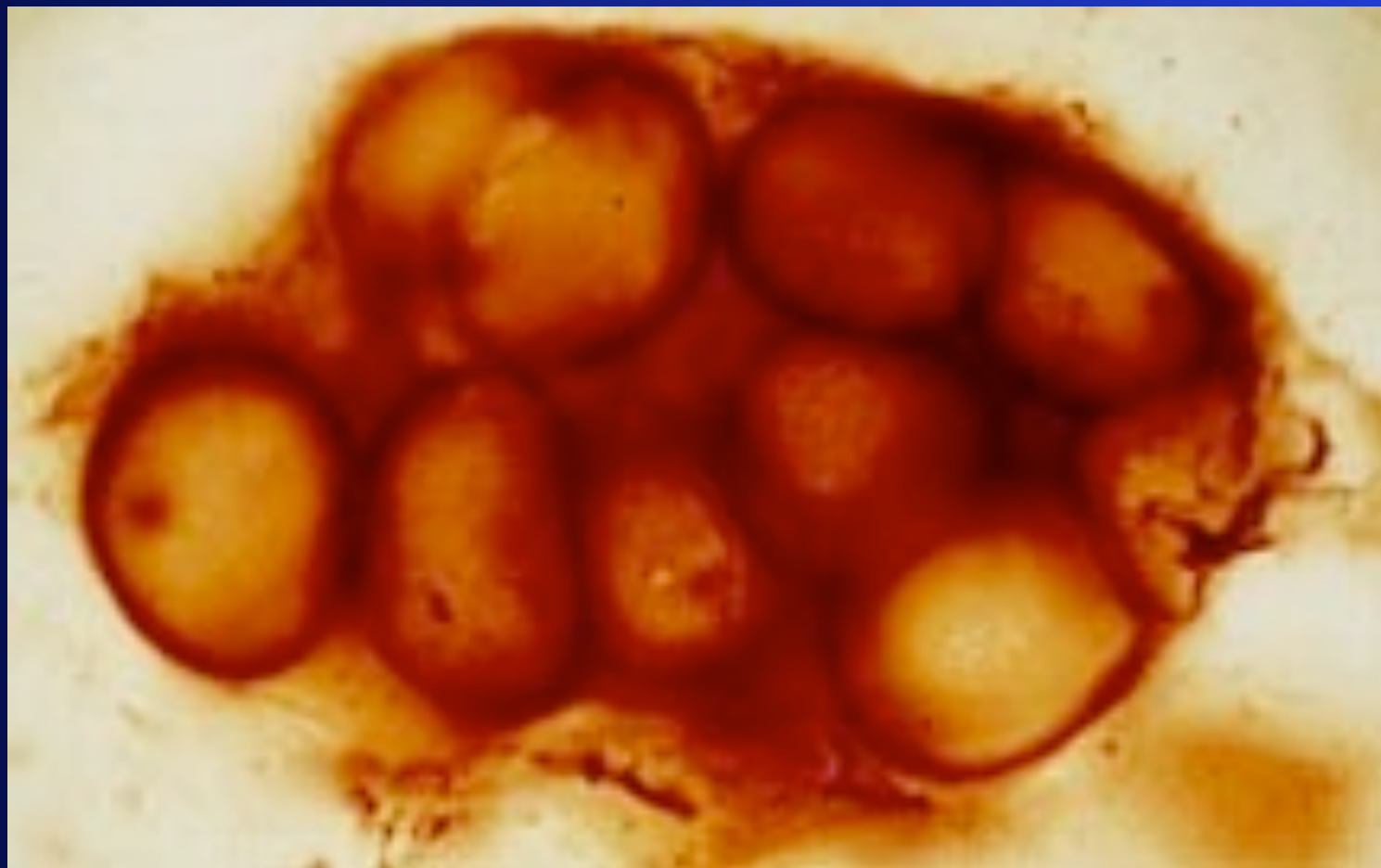


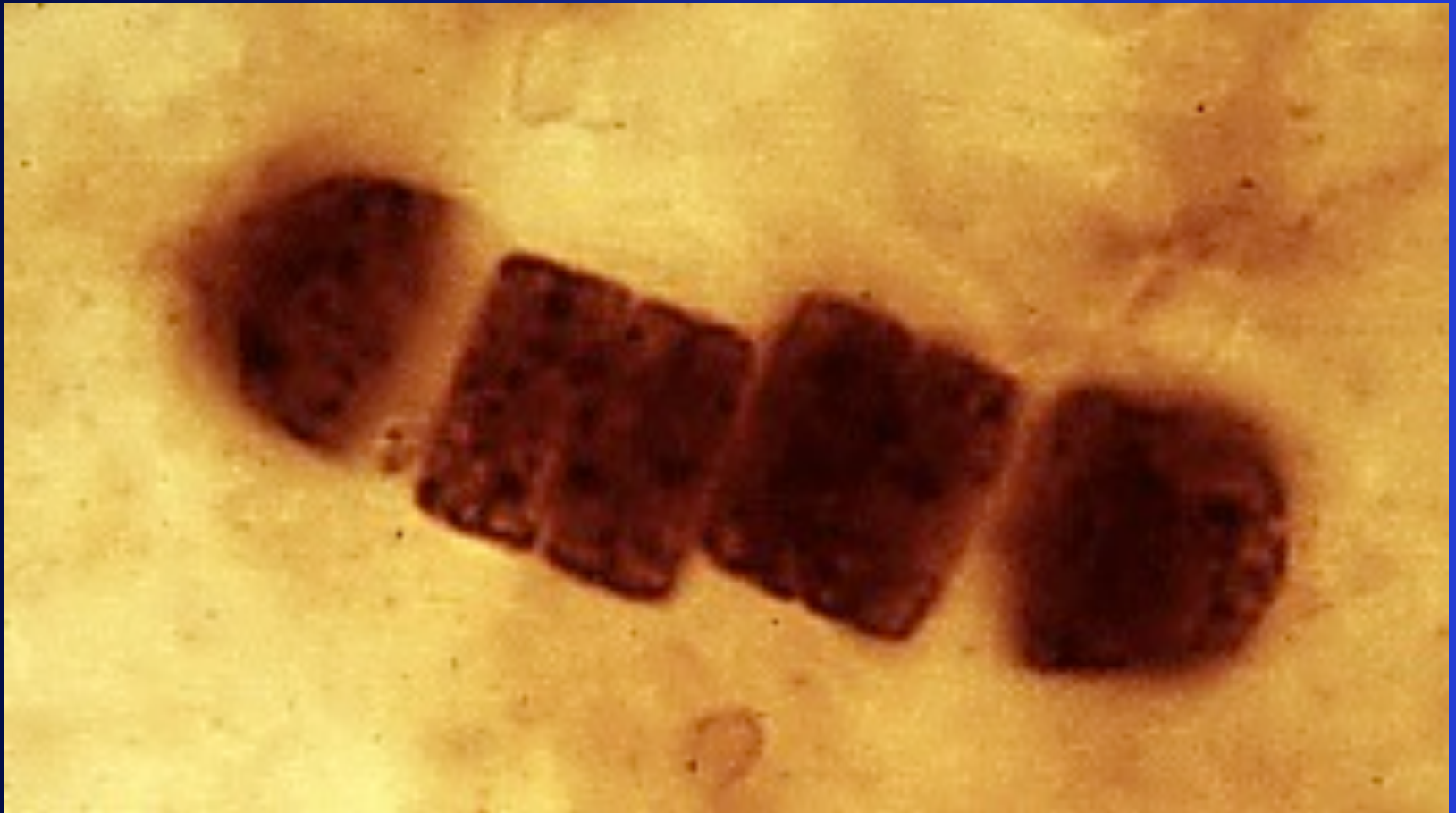


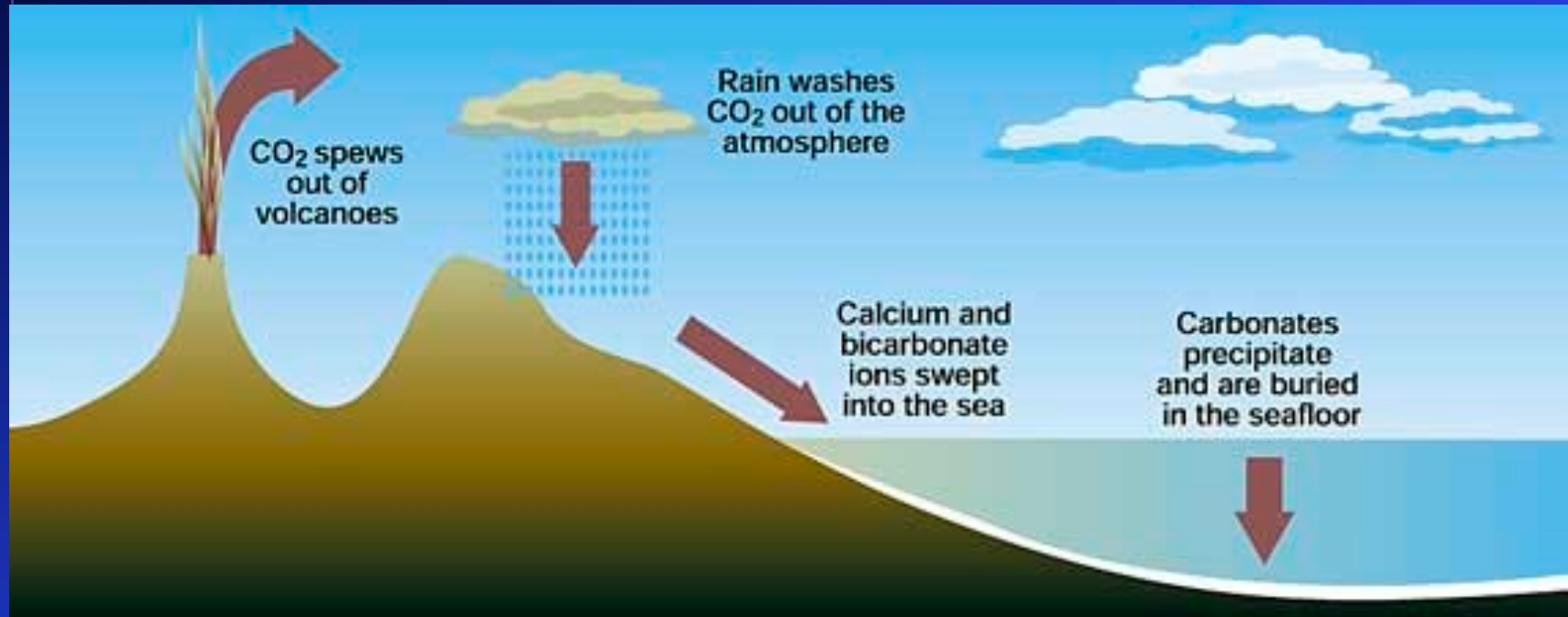
ALH84001,65















The Oxygen Catastrophe!

If free oxygen had existed in the atmosphere of the early Earth, Life would never have arisen....





The Easy Life?....



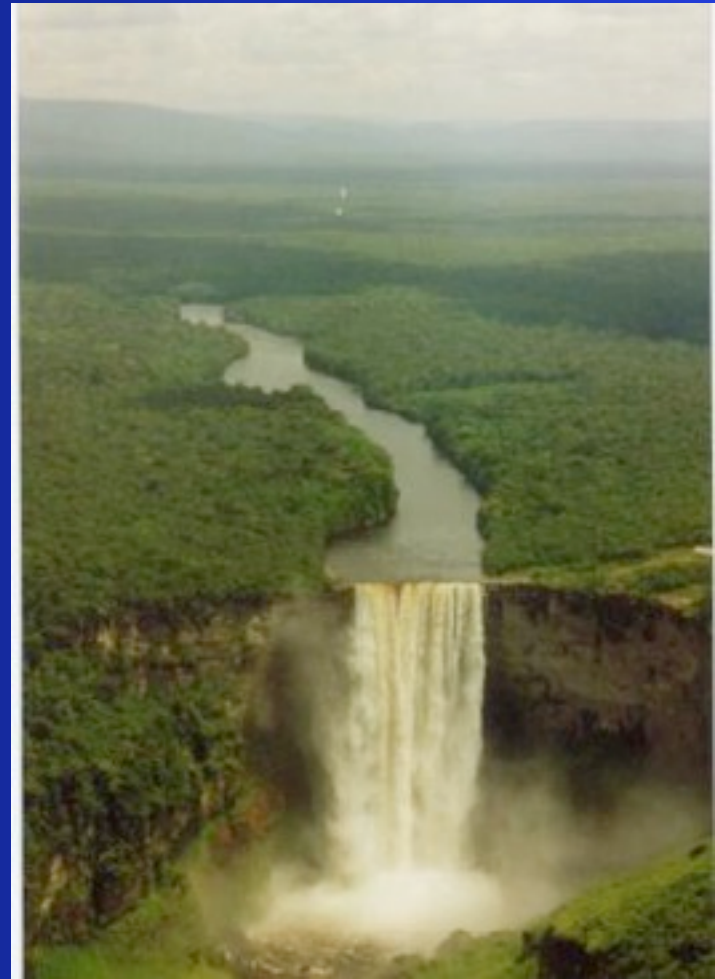
The Oxygen Life....

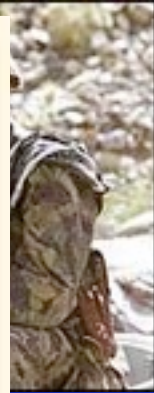
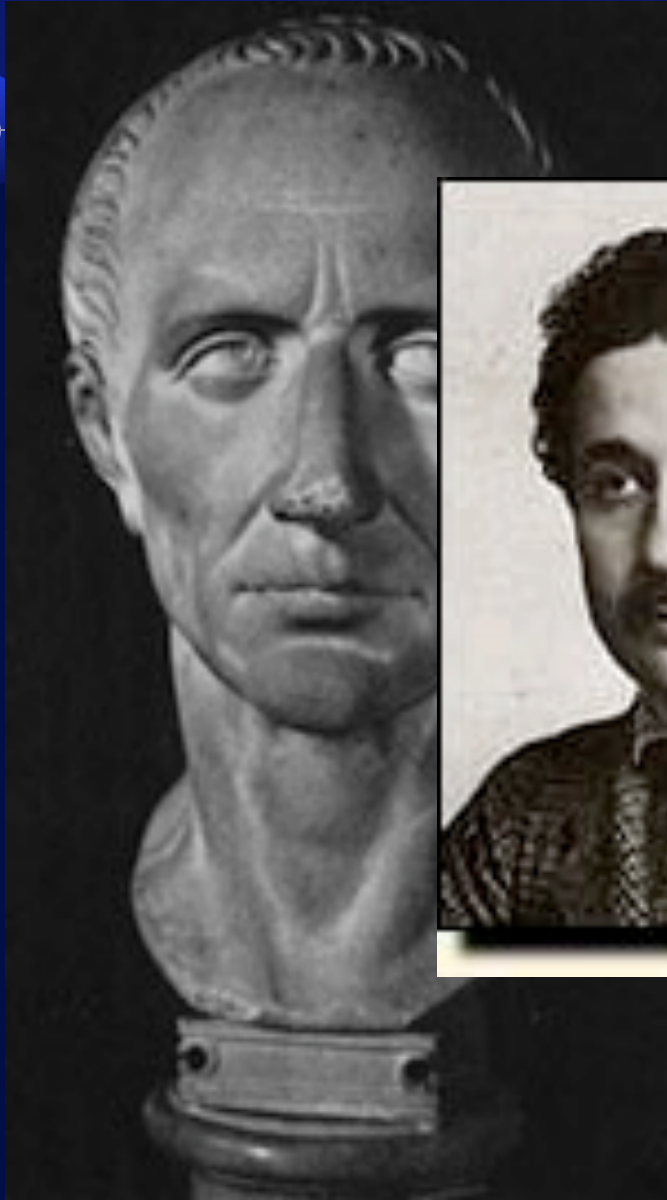


Born out of Crisis???









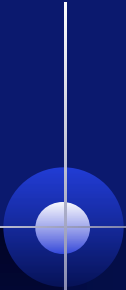
(AP PHOTO)



(AP PHOTO)







*...Will all great Neptune's ocean wash this blood
Clean from my hand? No, this my hand will rather
The multitudinous seas incarnadine...*

Macbeth,
William Shakespeare

Graduation Address (anonymous)

*“Things are going to get unimaginably worse,
and they are never, ever, going to get better
again!”*

