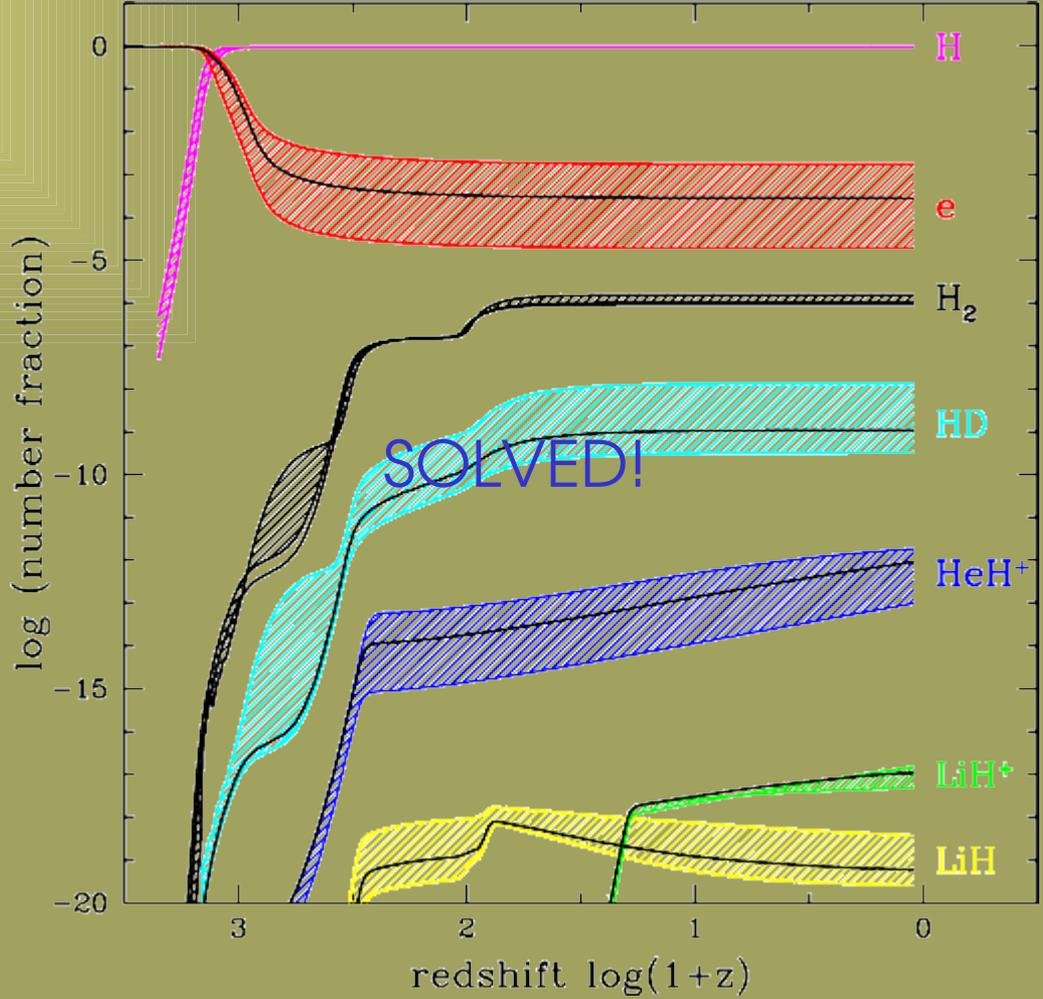


The “First” Game

— *Workshop/Discussion*—

THE FIRST molecules¹

WHICH ?



¹ just to wARM UP

THE FIRST MAGNETIC FIELD

WHEN ?

A. — Ab initio

B. — Prior to recombination

C. — During structure formation

YOUR VOTE:

THE FIRST STARS

WHERE ?

A. — “Minihalos” $T_{\text{vir}} < 10^4 \text{ K}$

B. — Dwarfs galaxies $M_{\text{h}} \approx 10^{8-10} M$

C. — Massive galaxies $M_{\text{h}} > 10^{10} M$

YOUR VOTE:

THE FIRST Black hole

HOW ?

A. — Primordial

B. — Stellar remnant

C. — Gas phase collapse

YOUR VOTE:

THE FIRST ionizing photon

FROM ?

A. — Stars

B. — (Mini)quasars

C. — Dark matter

YOUR VOTE:

THE FIRST HEAVY ELEMENTS

FROM ?

A. — Pair-instability supernova

B. — Type II supernova

C. — Planetary nebulae

YOUR VOTE:

THE FIRST DUST GRAIN

HOW ?

A. — H_2 ices

B. — Supernova ejecta

C. — Quasar Broad Emission Line clouds

YOUR VOTE:

THE FIRST QUASAR

WHERE ?

A. — Massive galaxy

B. — Normal galaxy

C. — Dwarf galaxy

YOUR VOTE:

THE FIRST GAMMA-RAY BURST

FROM ?

A. — Collapsar

B. — (Hyper-)Supernova

C. — Neutron star

YOUR VOTE:

THE FIRST LIVING CELL

... WHAT ??

FUN IS OVER. GO BACK TO WORK.



Primordial Magnetic Fields

Current Limits

CMB Anisotropies

$$B_0 \leq 7 \times 10^{-9} (\Omega h^2)^{1/2} \text{ G}$$

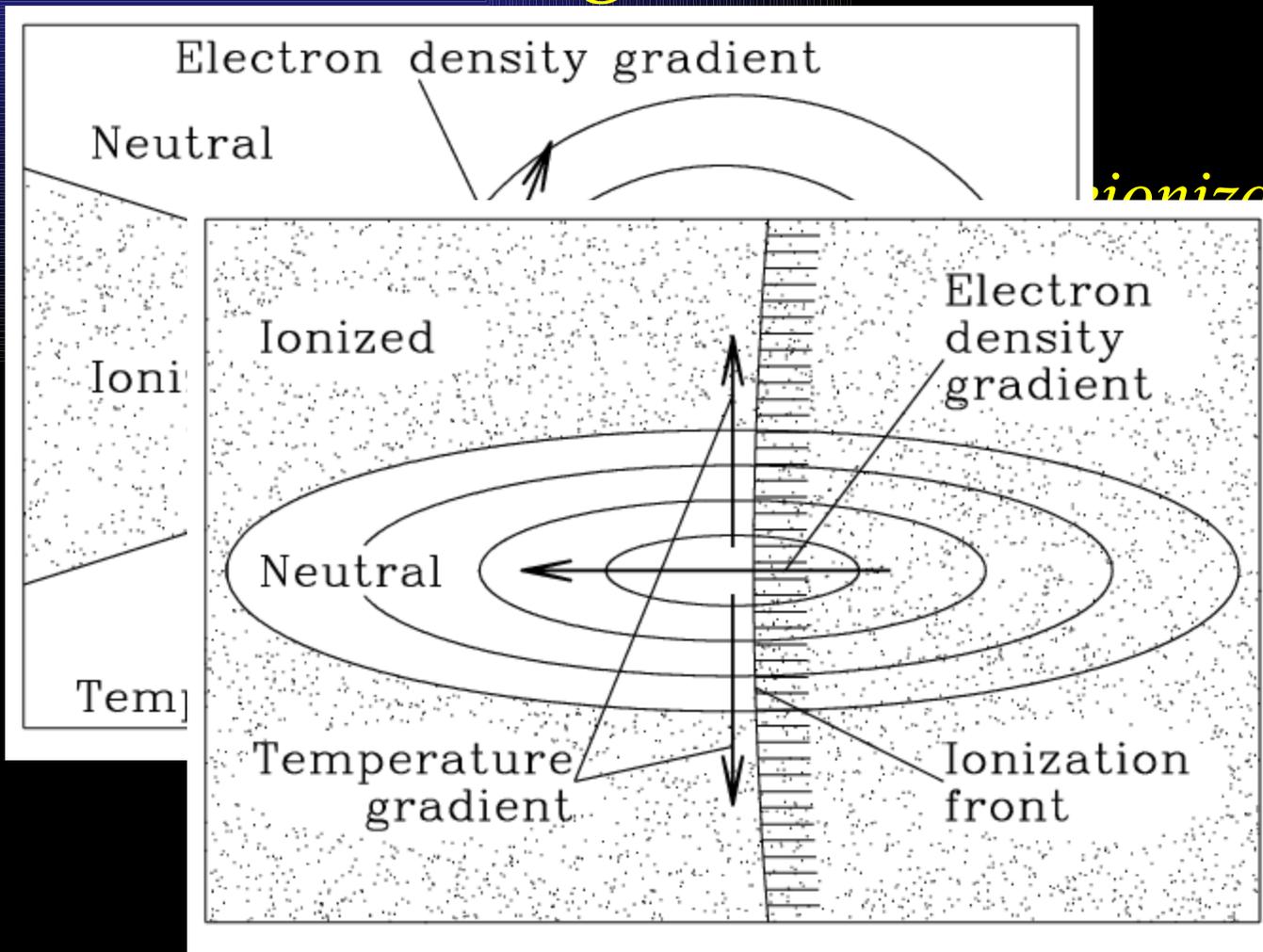
BBN

$$B_0 \leq 3 \times 10^{-7} \text{ G}$$

QSO absorbers $z = 3$

$$B_0 \approx 1 \times 10^{-6} \text{ G}$$

Primordial Magnetic Fields



ionization

$$\nabla T \times \nabla n_e$$

Source Term
Sternmann Battery