2. Klausur am Freitag, den 1.2.2008

9:15 – 10:45

Gruppen 1-6 Otto-Haxel Hoersaal im KIP

Gruppen 7-10 Grosser Hoersaal Physikalischen Inst. (hier)

Stoff: bis einschliesslich Vorlesung 23.1.

1 Zettel mit Notizen darf mitgebracht werden

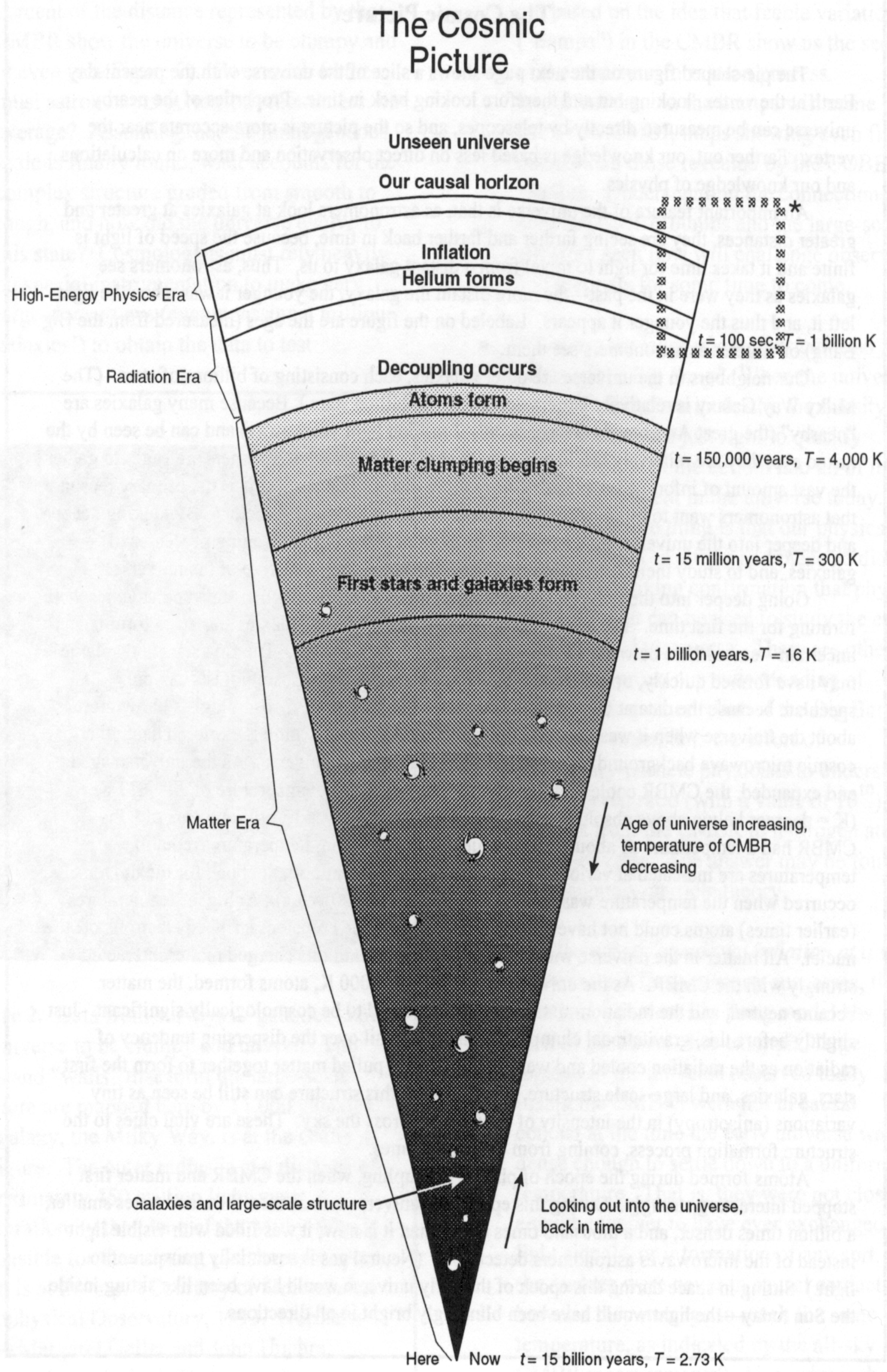
Konstanten werden am Ende der Klausuraufgaben gegeben

Seminar fuer mittlere Semester: Schluesselexperimente der Teilchenphysik

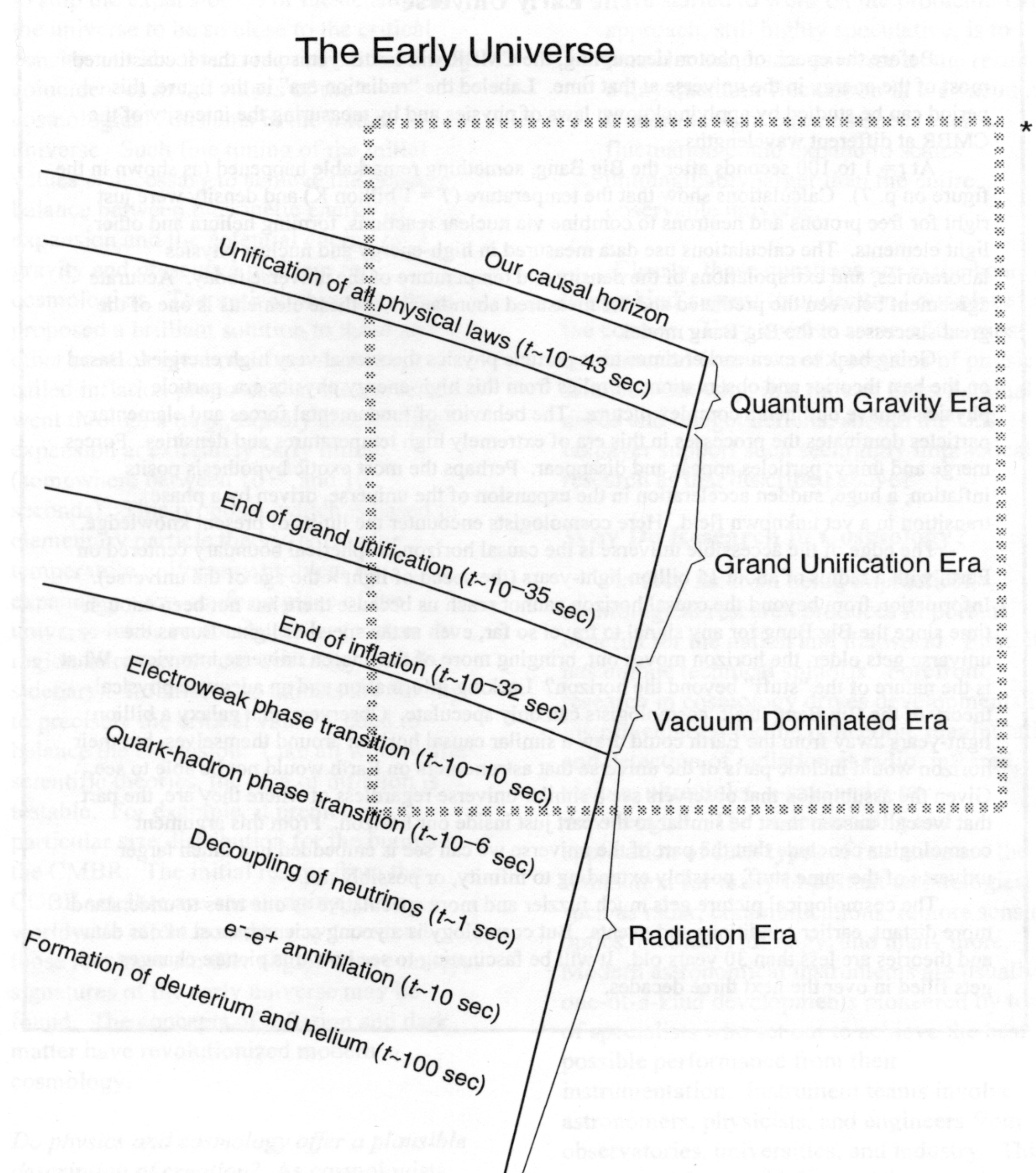
SS 2008, Freitag 11:15

Vorbesprechung Freitag 1.2.2008, 11:15 Grosser Hoersaal PI

Themenvergabe!



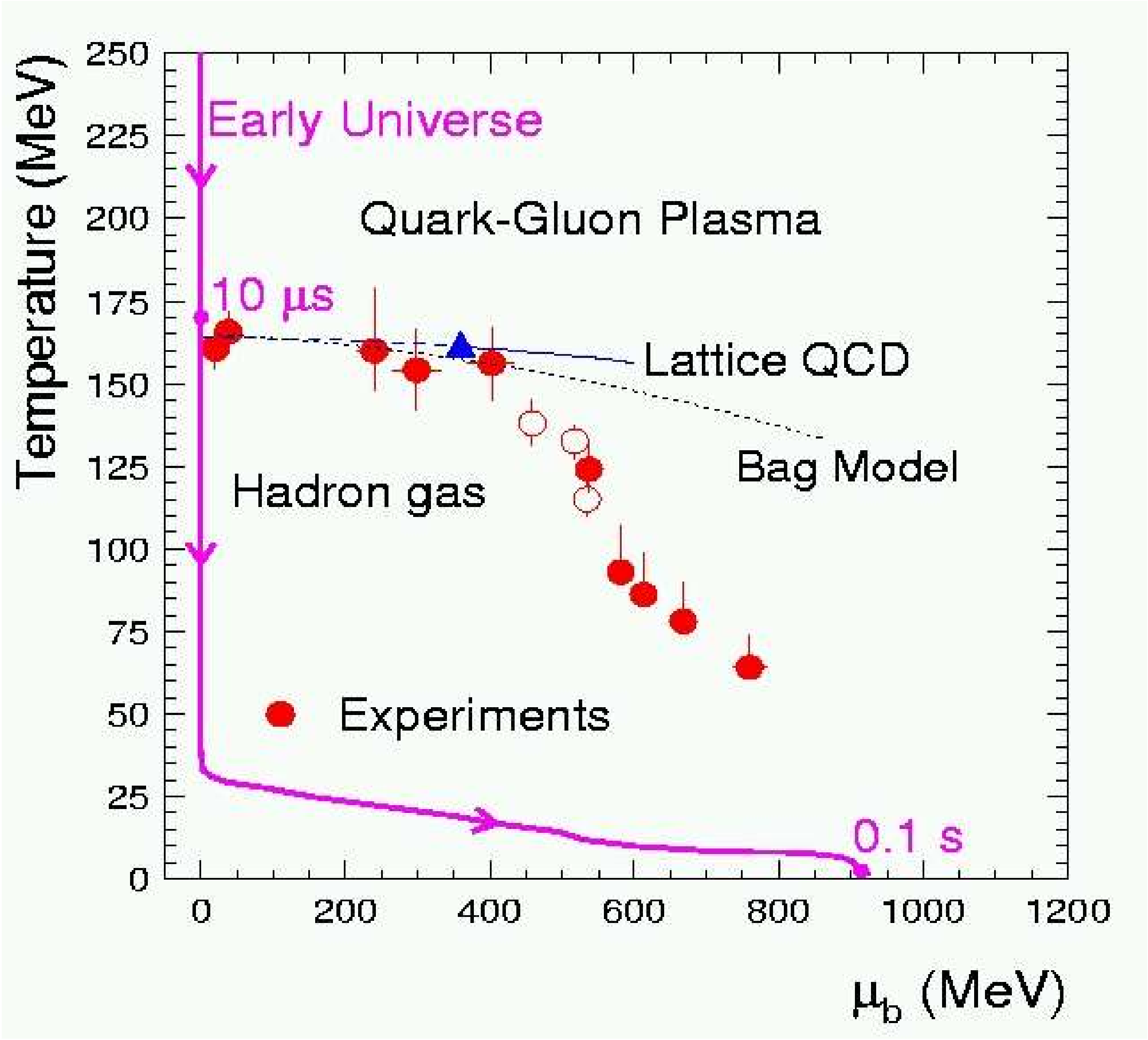
The Cosmic Picture
Unseen universe
Our causal horizon
*
Inflation
Helium forms
High-Energy Physics Era
t = 100 sec, T = 1 billion K
Radiation Era
Decoupling occurs
Atoms form
Matter clumping begins
t = 150,000 years, T = 4,000 K
t = 15 million years, T = 300 K
First stars and galaxies form
t = 1 billion years, T = 16 K
Matter Era
Age of universe increasing, temperature of CMBR decreasing
Galaxies and large-scale structure
Looking out into the universe, back in time
Here
Now
t = 15 billion years, T = 2.73 K



The Early Universe
*
Our causal horizon
Unification of all physical laws (t~10−43 sec)
Quantum Gravity Era
End of grand unification (t~10−35 sec)
Grand Unification Era
End of inflation (t~10−32 sec)
Electroweak phase transition (t~10−10 sec)
Vacuum Dominated Era
Quark-hadron phase transition (t~10−6 sec)
Decoupling of neutrinos (t~1 sec)
e−e+ annihilation (t~10 sec)
Radiation Era
Formation of deuterium and helium (t~100 sec)

Phasendiagramm stark wechselwirkender Materie und die Entwicklung des fruehen Universums

- in Kern-Kern-Kollisionen an Beschleunigern etabliert



Hertzsprung-Russell Diagramm der Sterne:

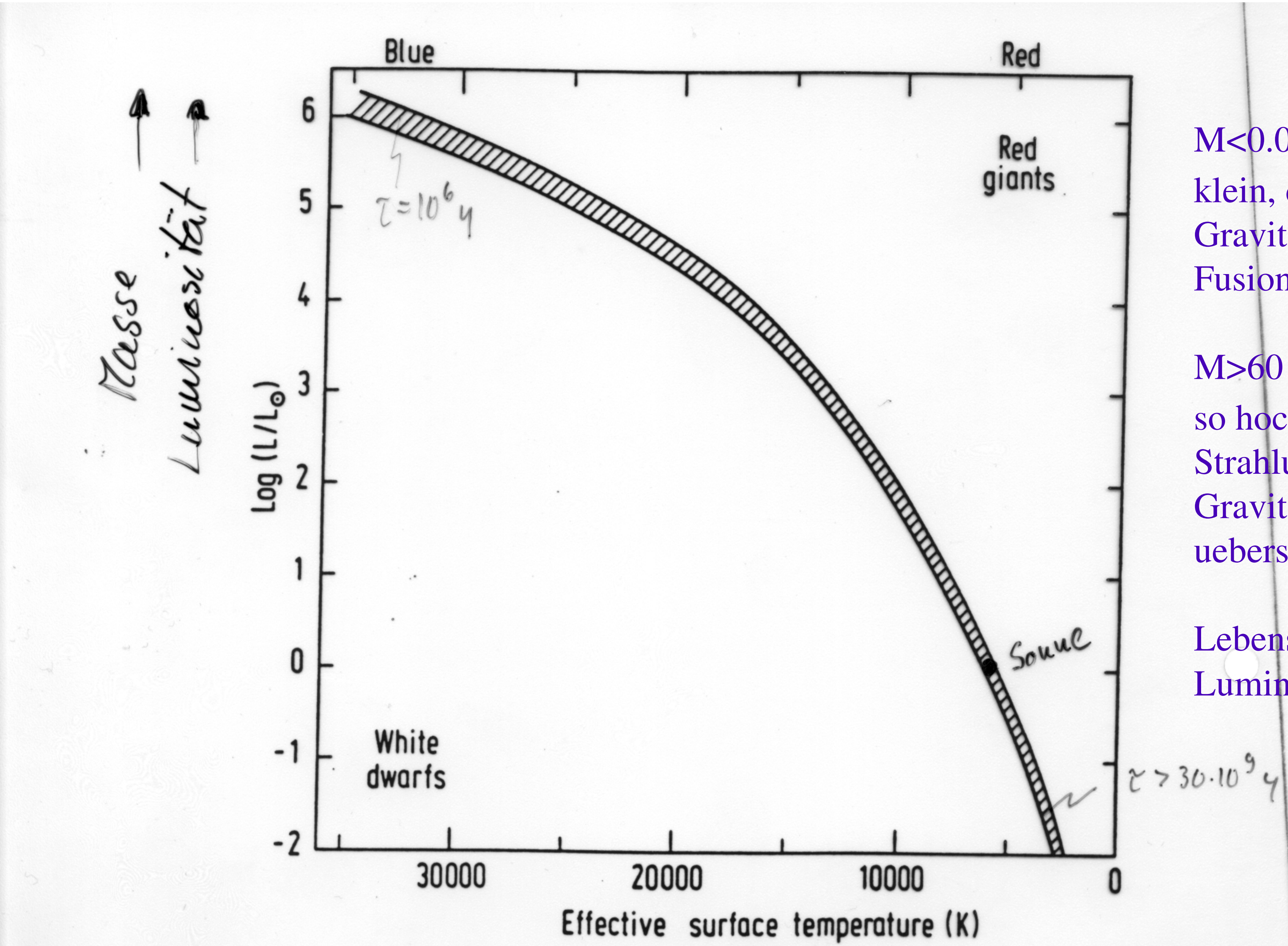
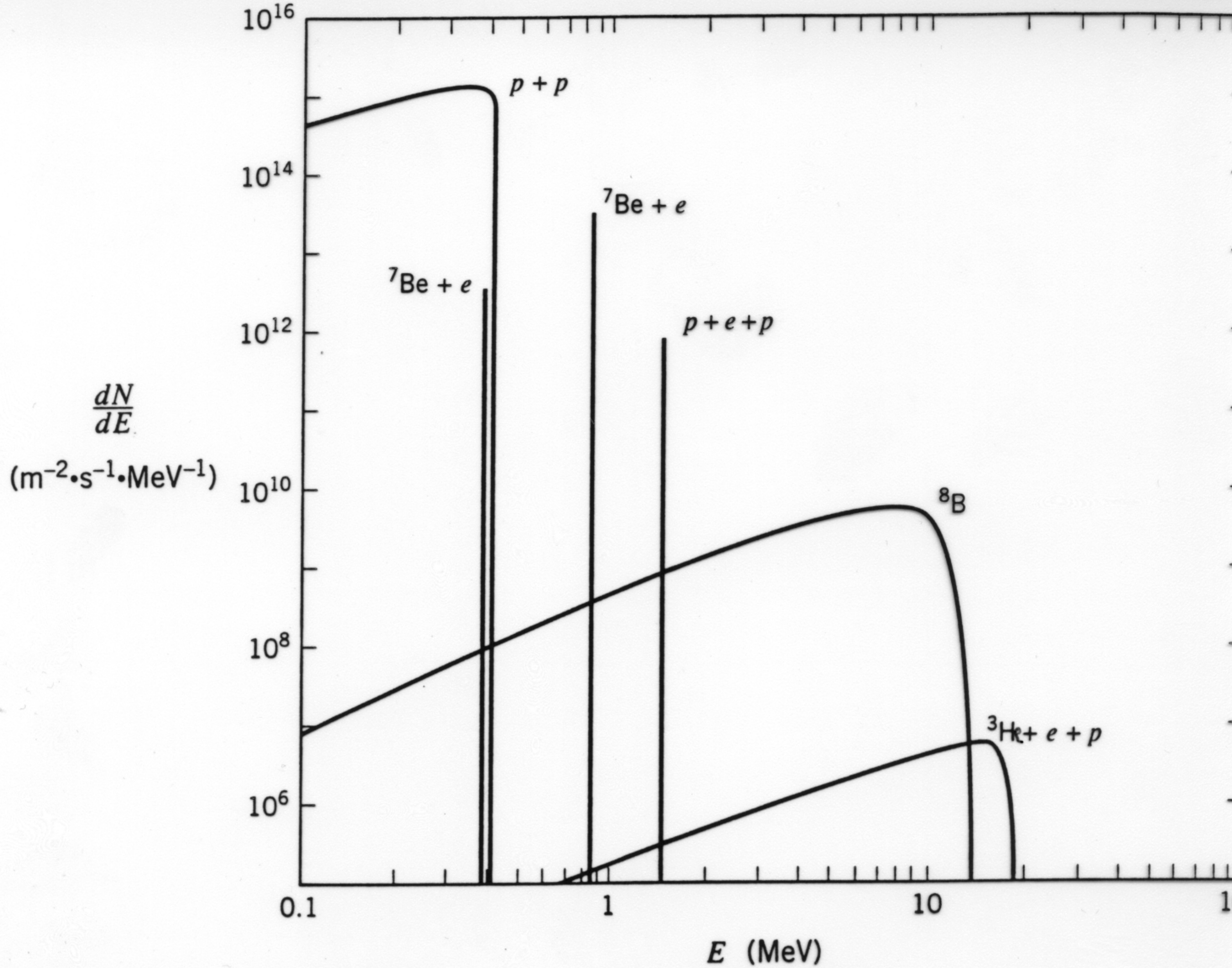


Fig. 13-7 Schematic H-R diagram. The ordinate is luminosity relative to that of the sun. logarithmic scale. The diagonal band is the main sequence.

$M<0.08\ M_{solar}$: Masse zu klein, dass durch Gravitation im Innern Fusion moelgich wuerde

$M>60\ M_{solar}$: T wuerde so hoch, dass Strahlungsdruck den Gravitationsdruck ueberschreitet

Lebensdauer ∞ Energie / Luminositaet ∞ Mc^2/M^4 $= M^{-3}$



RE 11-15 Calculated neutrino flux from the sun incident on the earth.
utrinos are produced by nuclear fusion inside the sun. The spectrum consists of β spectra from ody final states and lines from two-body final states. The height of the lines is plotted so that le gives the flux in $m^{-2} \cdot s^{-1}$. Flux calculations are reported by J. N. Bahcall and R. K. Ulrich, Models, Neutrino Experiments, and Helioseismology," *Rev. Mod. Phys.* **60**, 297 (1988).

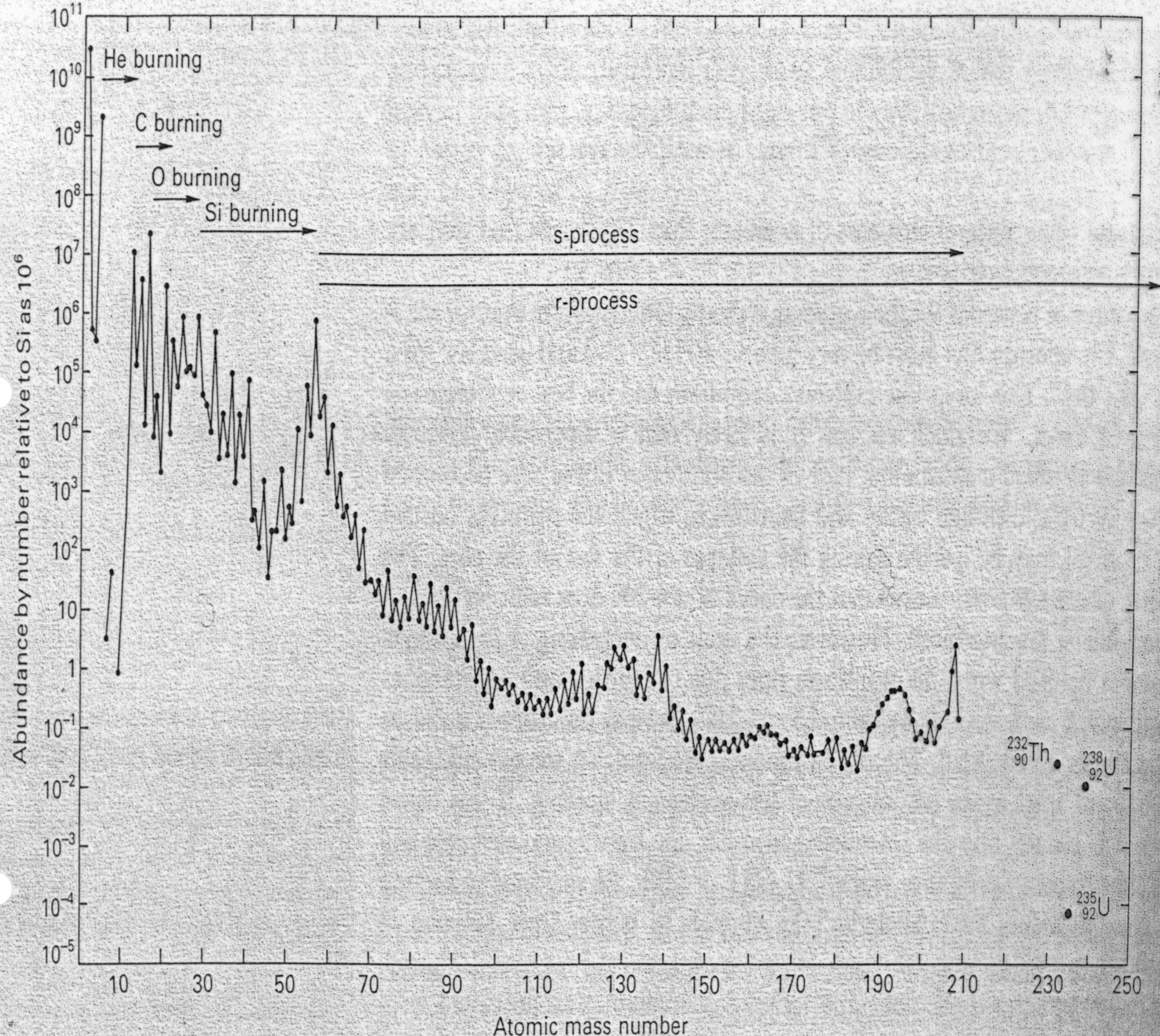
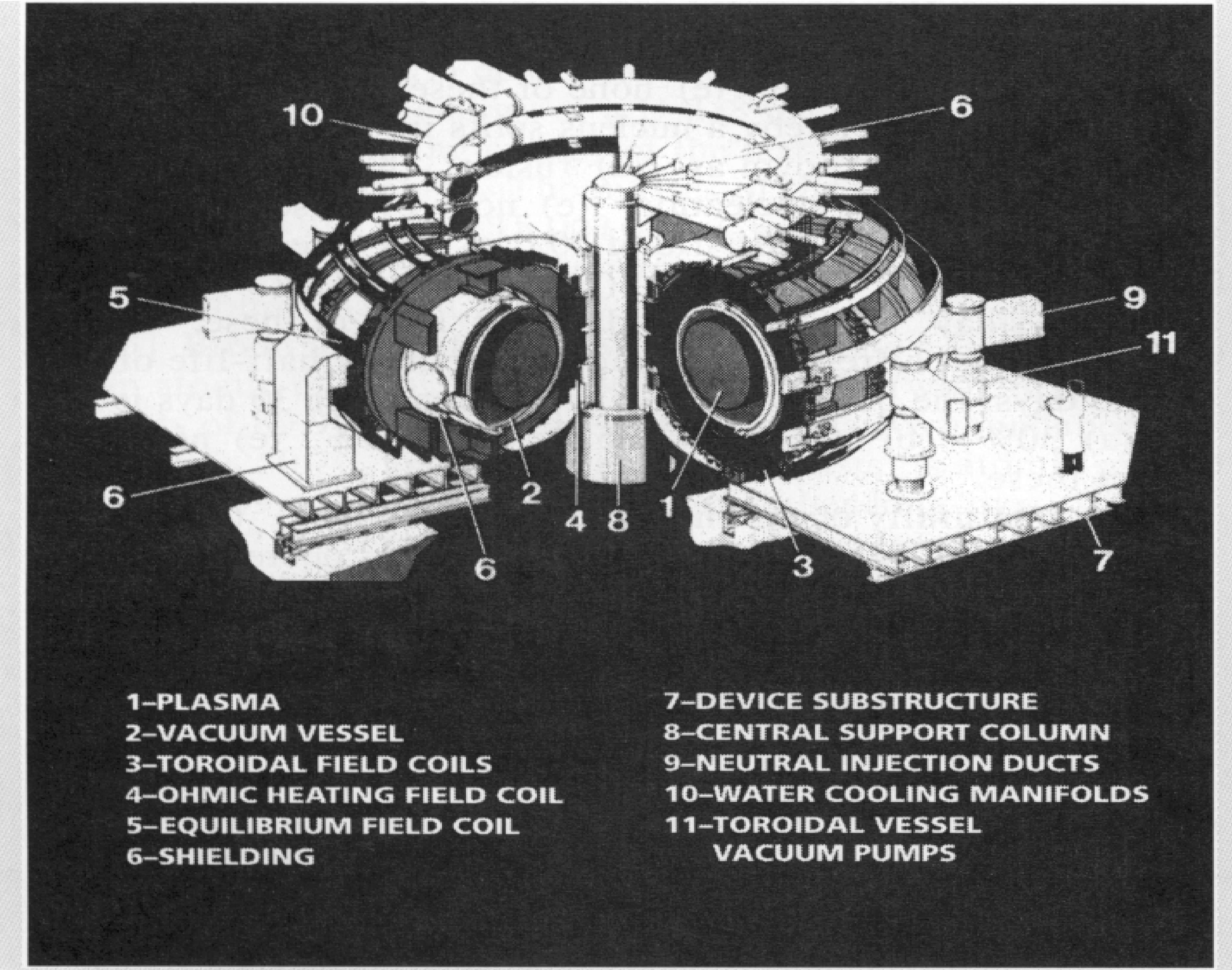


Fig. 14.3 The abundance by number of atoms relative to $^{28}_{14}Si + ^{29}_{14}Si + ^{30}_{14}Si$ as 10^6 in the solar system, as a function of the atomic mass number A. The relative H, He abundances are close to those existing after Big Bang nucleosynthesis. The obvious absences are those of $A = 5,8$, and $A > 209$ apart from $^{232}_{90}Th$, $^{234}_{92}U$ (not shown), $^{235}_{92}U$ and $^{238}_{92}U$. Large abundances occur for the even–even nuclei at $A = 12$, 16, 20, 24, 28, 32, and 40. The broad peak near $A = 56$ is the iron-like elements, noted as those with the greatest binding energy per nucleon in the periodic table. The abundance enhancing effect of magic numbers are also seen!

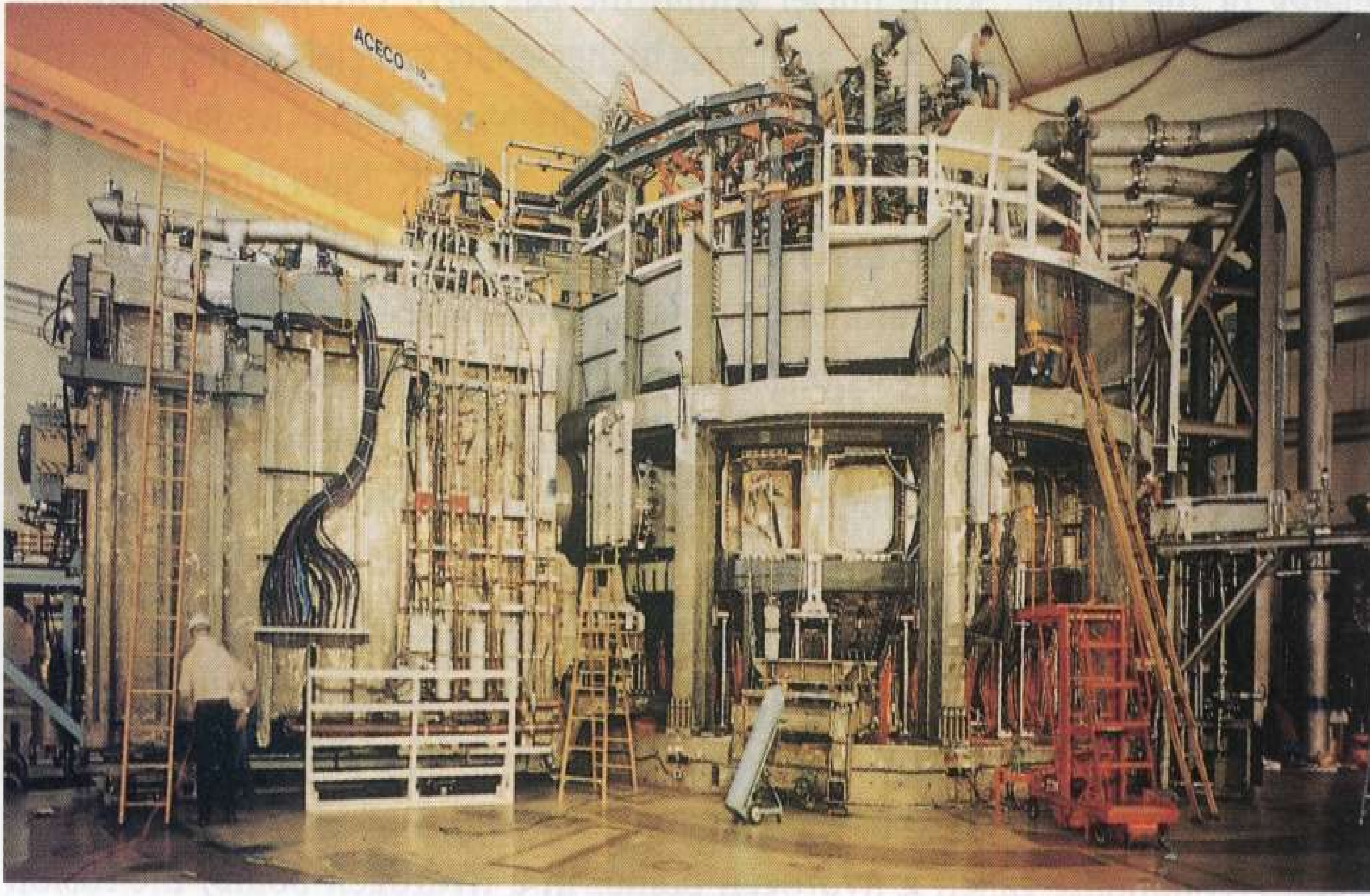
(1) at $A = 86$ to 90 due to $N = 50$,
(2) at $A = 114$ to 120 due to $Z = 50$,
(3) at $A = 138$ due to $N = 82$,
(4) at $A = 208$ due to $Z = 82$, $N = 126$.

In addition, the even-to-odd A abundance due to the pairing term effect on the binding energy is clearly visible.

Prinzip eines Tokamak Fusions-Reaktors:



Princeton Tokamak Fusions-Reaktor:



Fusion durch Traegheitseinschluss in Livermore National Laboratory: