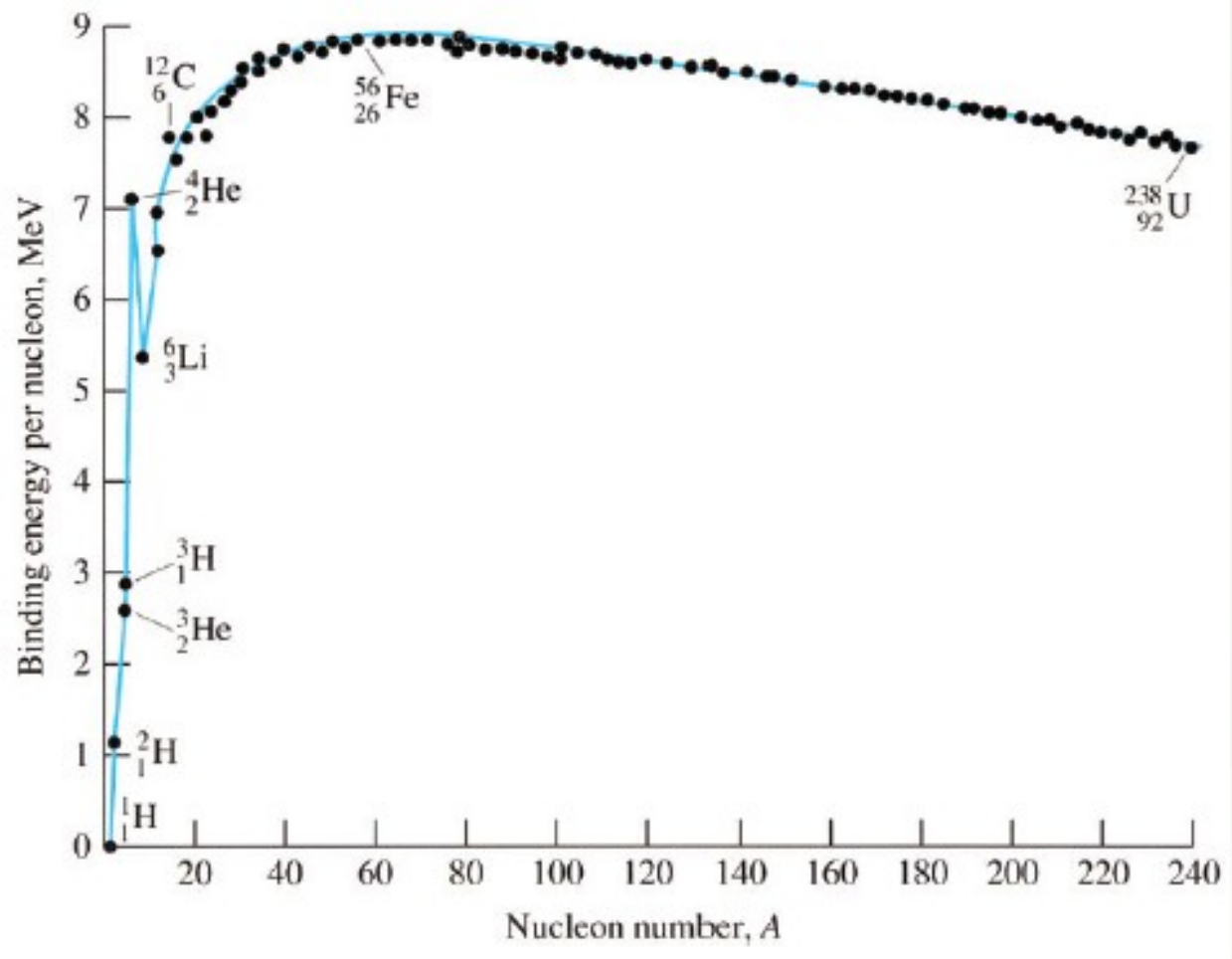
Teoretična astrofizika

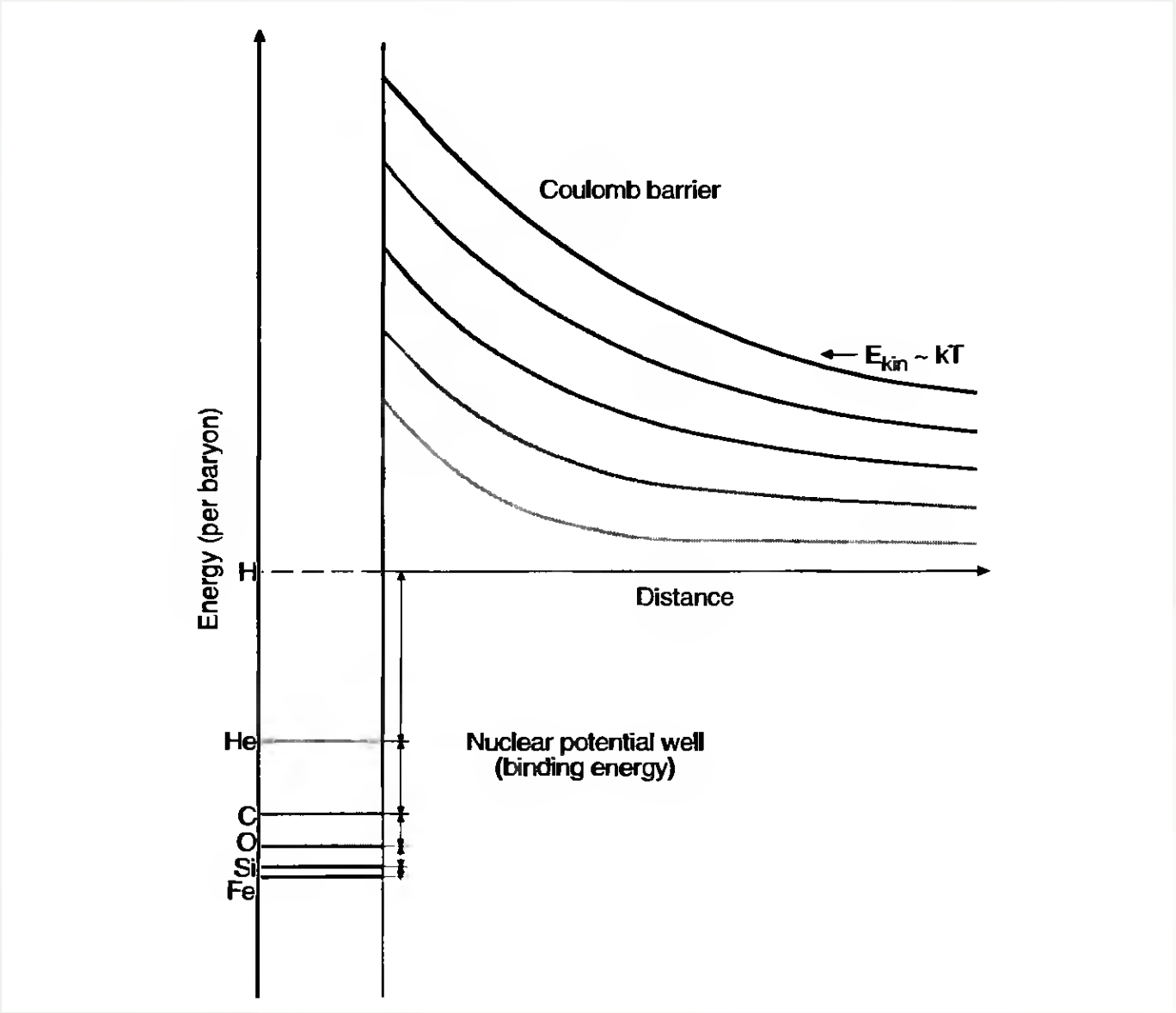
razumevanje stanja in razvoja zvezd ter njihove okolice

Vezavna energija



Vezavna energija na nukleon (v MeV) v odvisnosti od masega števila A

Coulombova pregrada



Hitrost jedrskih reakcij

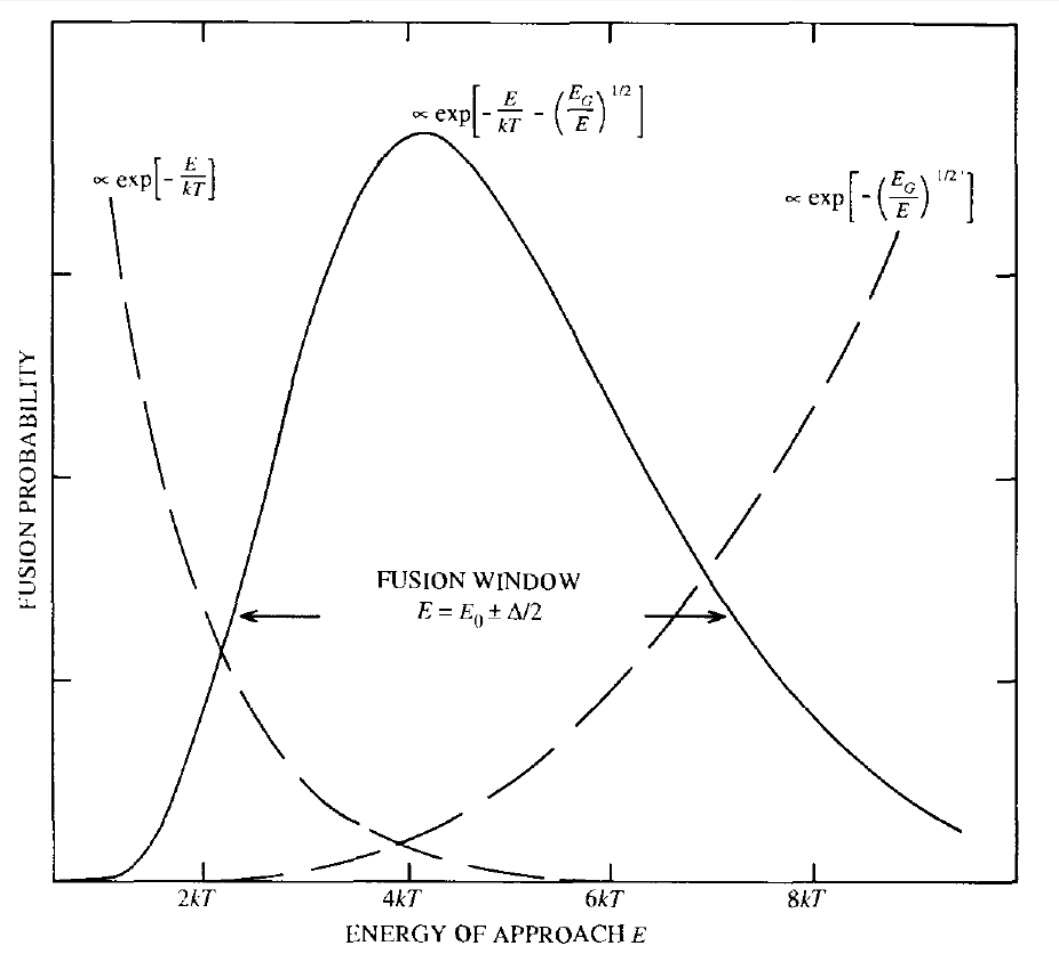
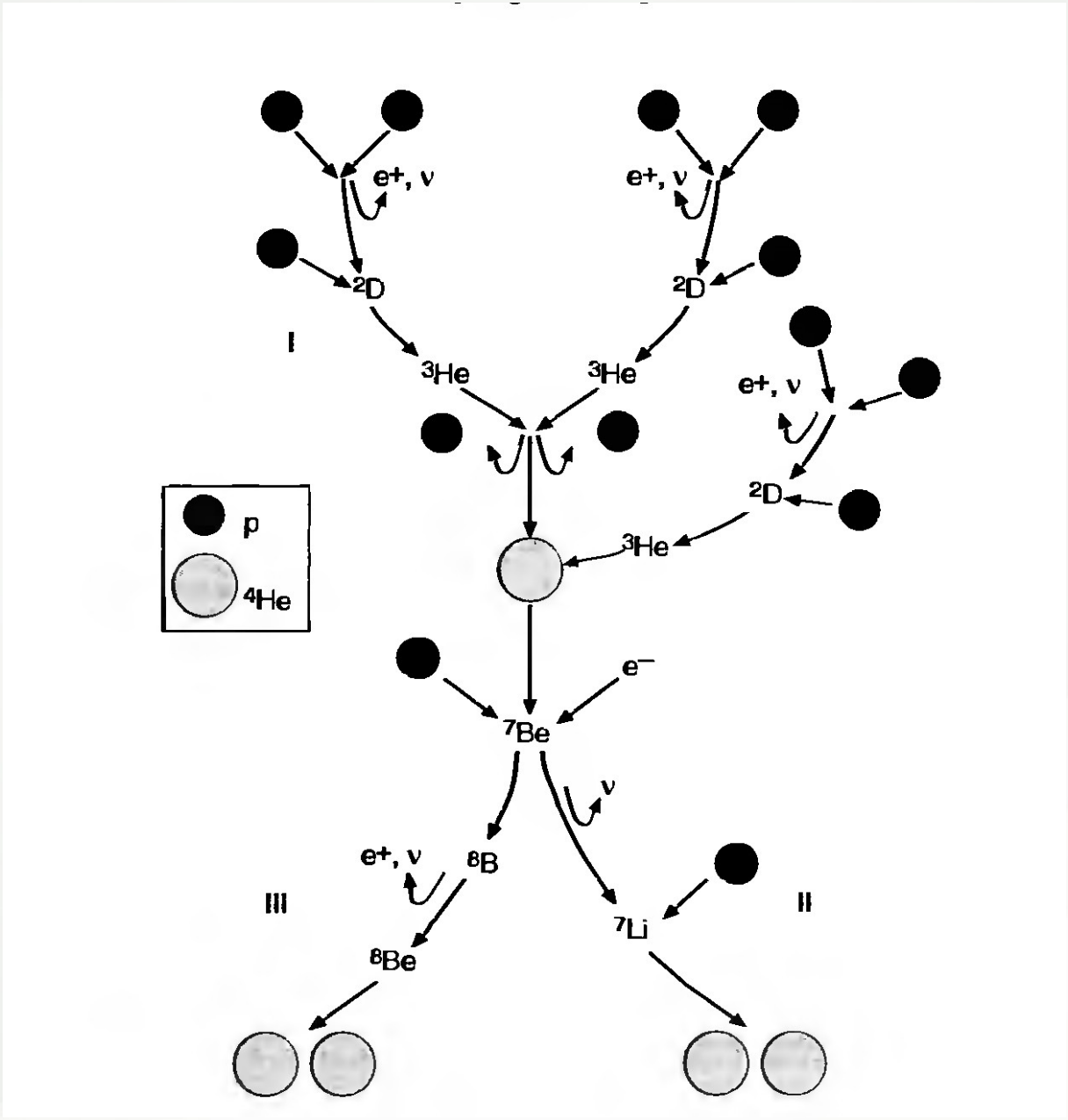


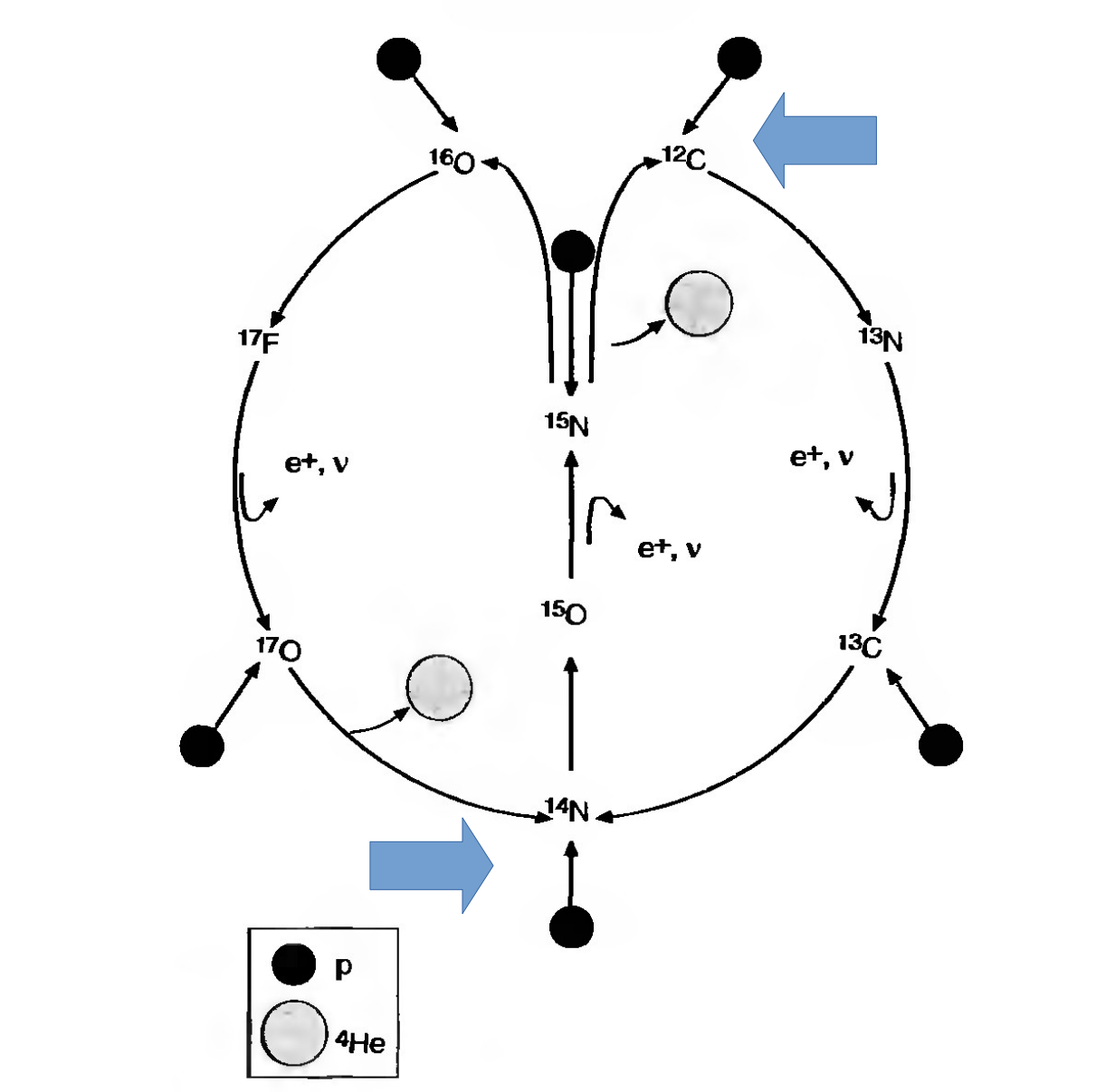
Fig. 4.3 The energy window for the fusion of nuclei with a Gamow energy E_G and temperature T. To react at energy E, the nuclei need to borrow an energy E from the thermal environment, and the probability of a successful loan is proportional to the Boltzmann factor $\exp[-E/kT]$. To fuse, the nuclei must first penetrate the Coulomb barrier keeping them apart, and the probability of penetration is given by the factor $\exp[-(E_G/E)^{1/2}]$. The product of these two factors indicates that fusion mostly occurs in an energy window $E_0 \pm \Delta/2$. For the fusion of two protons at 2×10^7 K, $E_G = 290kT$, $E_0 = 4.2kT$, and $\Delta = 4.8kT$, as illustrated.

Phillips A.C. - The physics of stars

Vodik: verige p-p



Vodik: CNO cikel

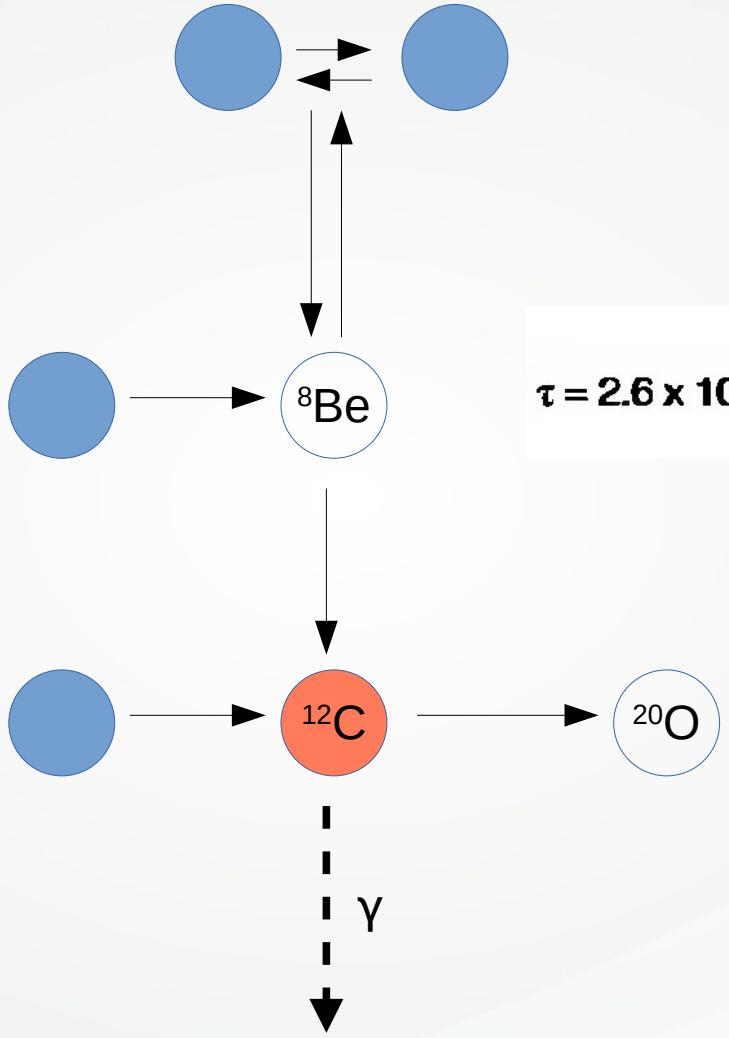


Helij

p

n

α (^{4}He)



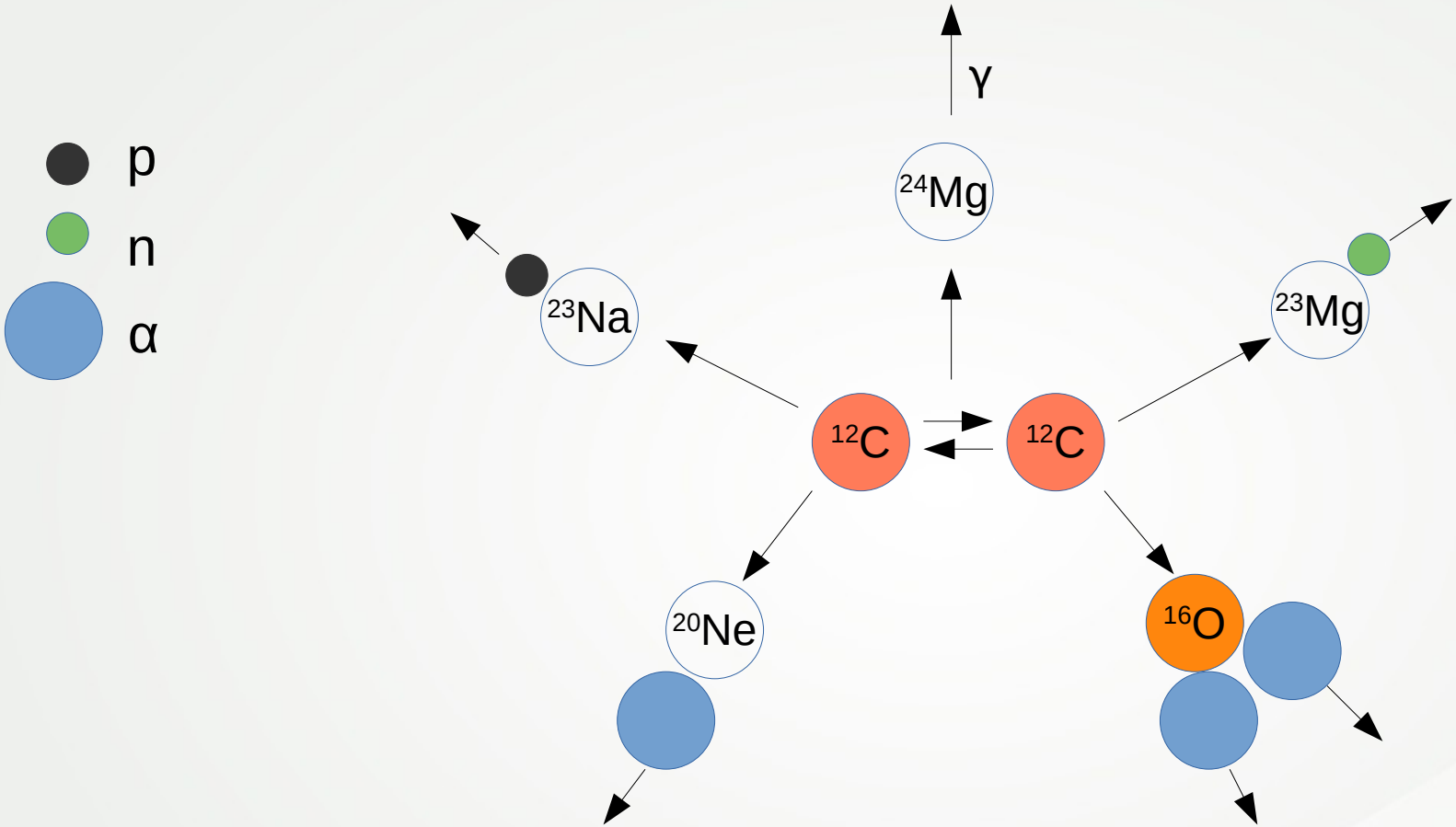
$\tau = 2.6 \times 10^{-16}$ sec > τ scat

$T \approx 10^8$K

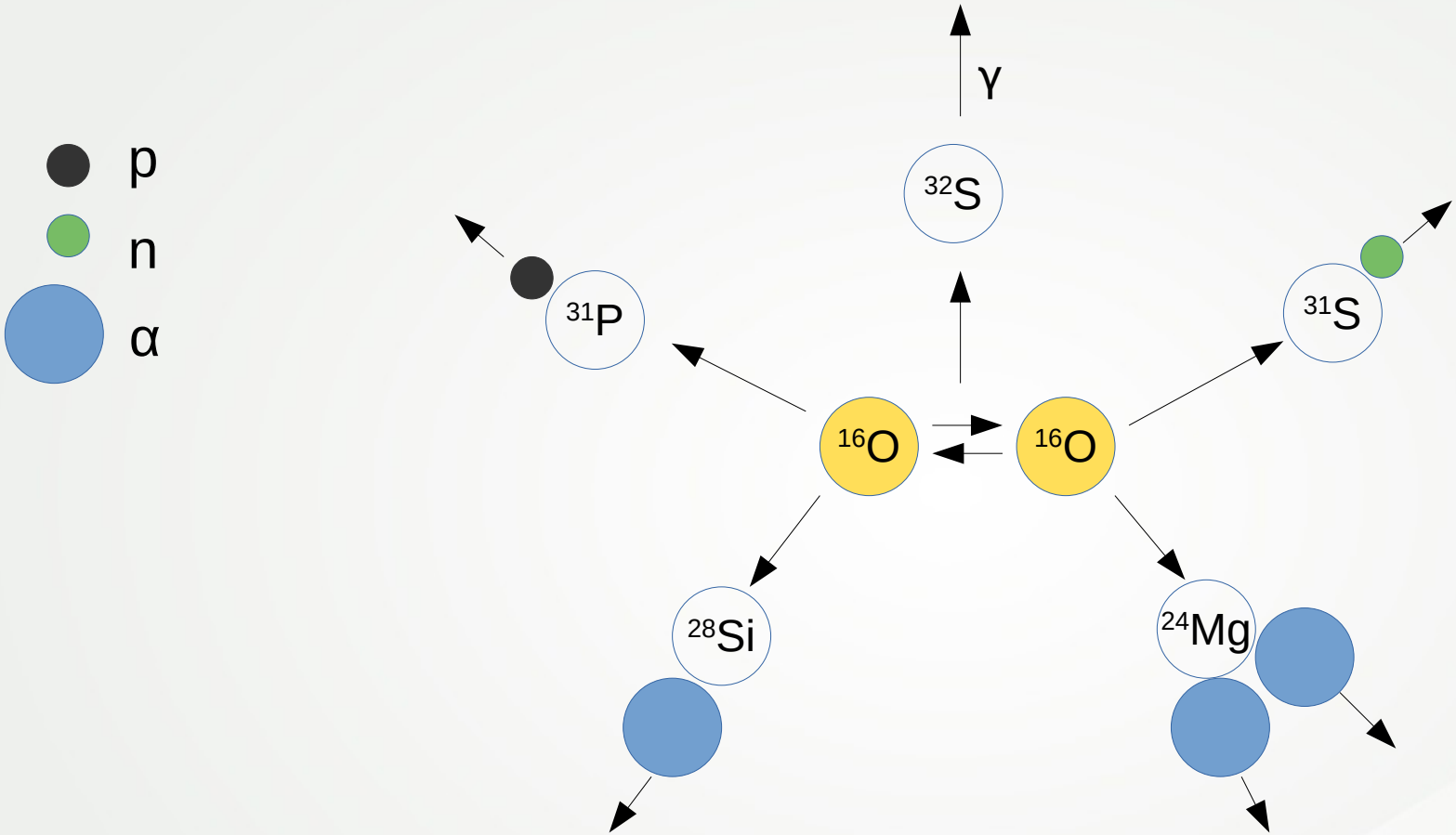
$\rho = 10^5$g cm^{-3}

$\Longrightarrow$ $n(^8\text{Be}) : n(^4\text{He}) = 1 : 10^9$

Ogljik



Kisik



Glavni jedrski procesi

jedrsko gorivo	proces	mejna temperatura (v 10^6 K)	proizvedeni element	Energija na nukleon (MeV)
H	p-p	~4	He	6,55
H	CNO	15	He	6,25
He	3α	100	C, O	0,61
C	C+C	600	O, Ne, Na, Mg	0,54
O	O+O	1000	Mg, S, P, Si	~0,3
Si	jedrsko ravnovesje	3000	Co, Fe, Ni	< 0,18

r in s-procesi

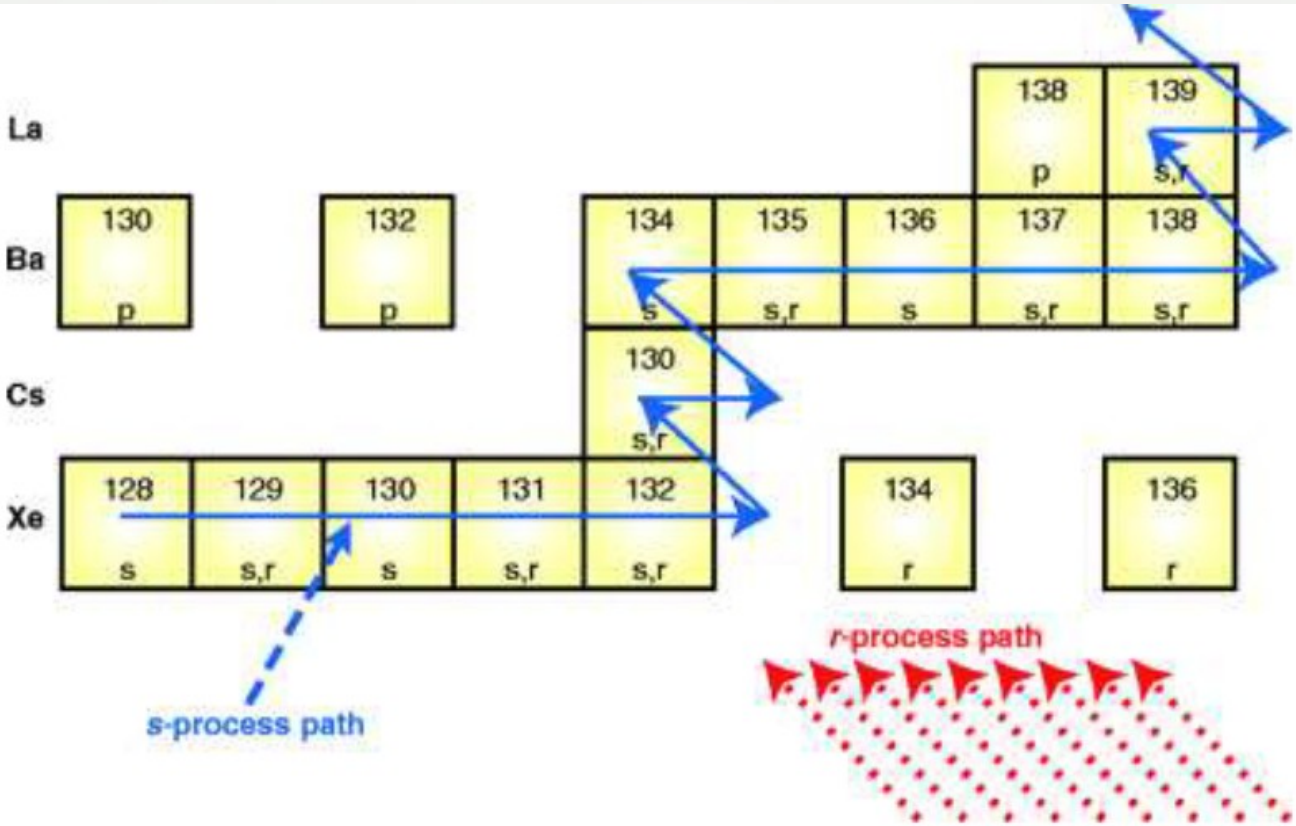


Figure 1: A small portion of the chart of the nuclides, illustrating isotopes built by the three basic processes. Only stable isotopes are shown, and letters indicate the processes that can contribute to these isotopes.

Lane-Emdenove enačbe

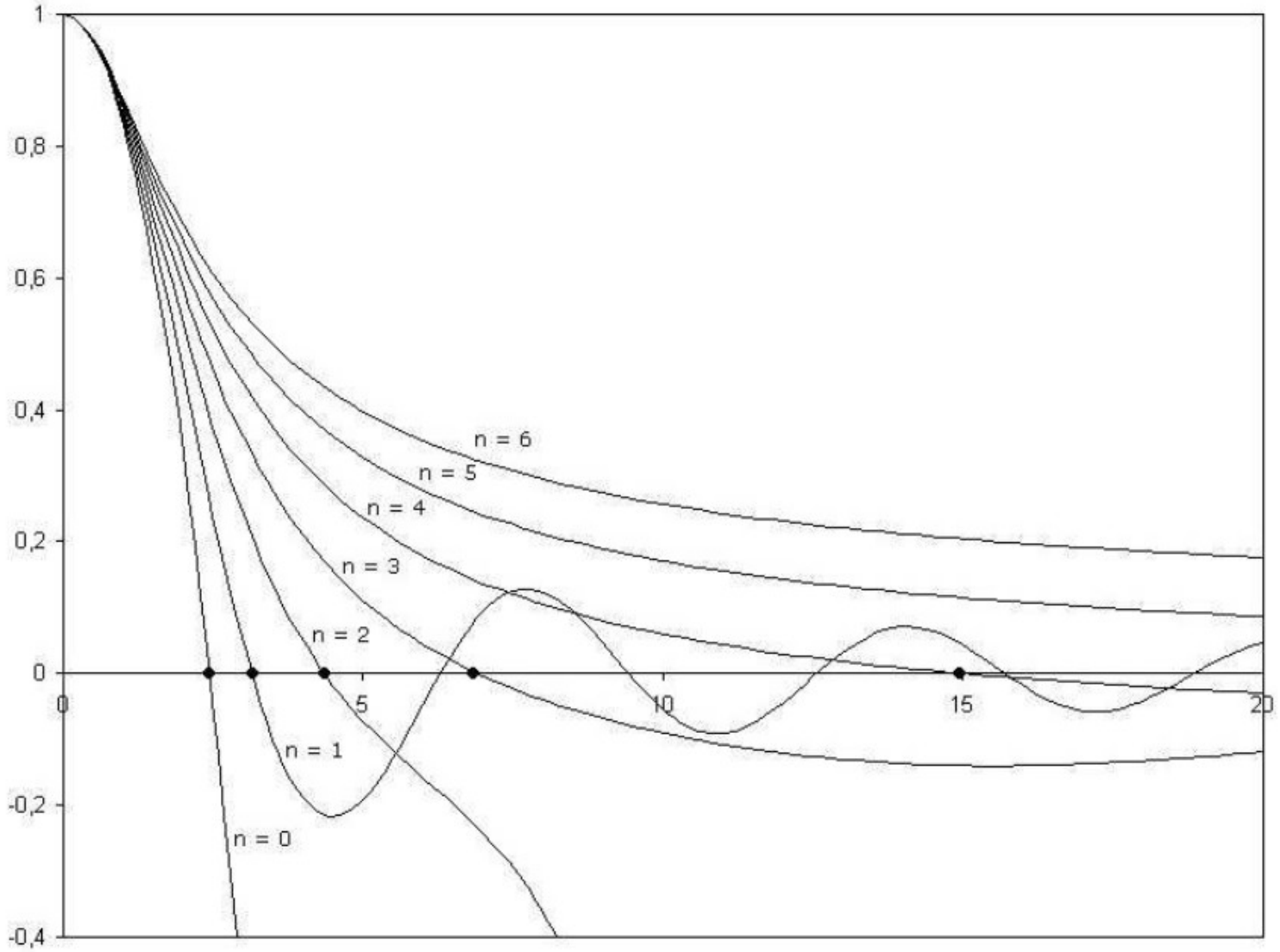


Fig. 2.— Solutions $\theta(\xi)$ to the Lane-Emden equation for various values of n. The black dot along the horizontal line (denoting $\theta = 0$) marks the value of ξ_1 for each solution displayed.