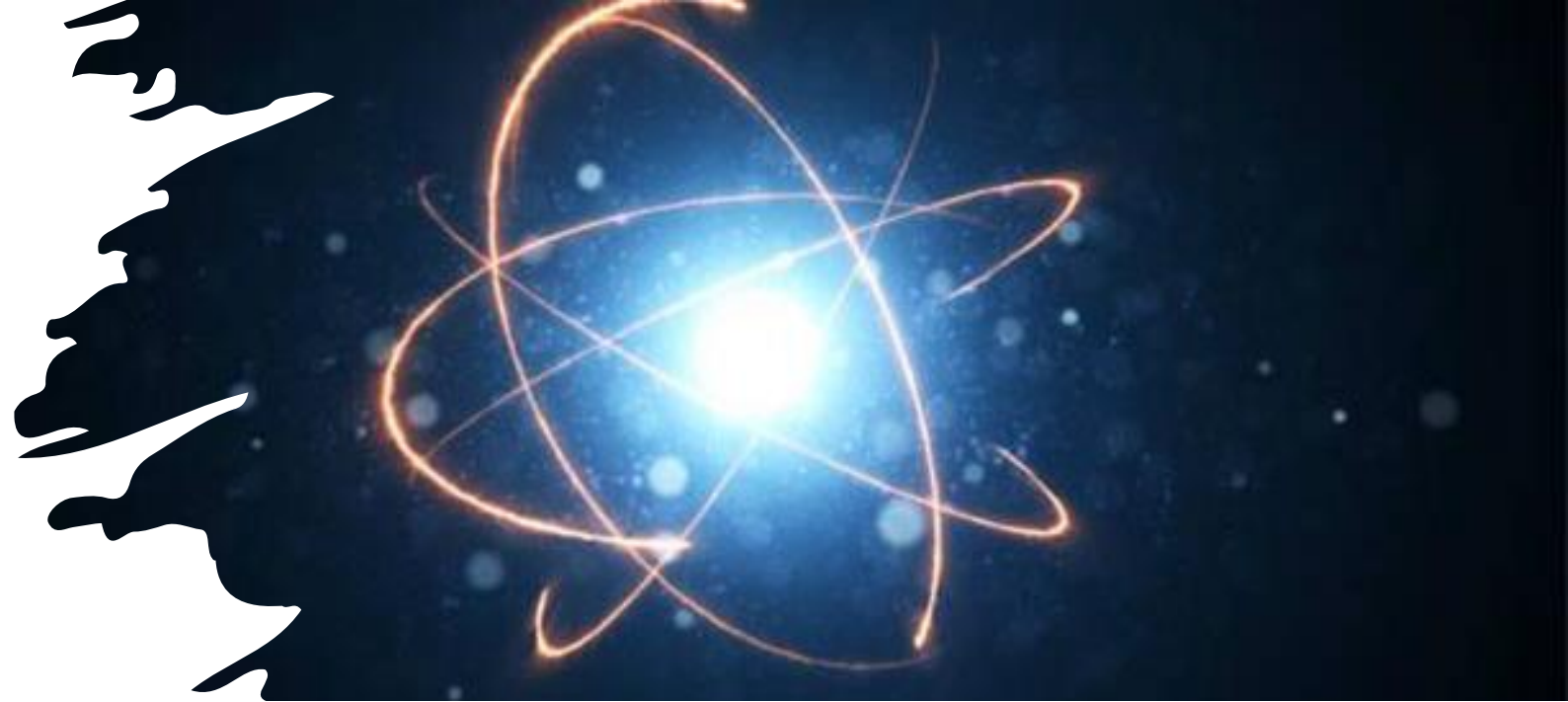


Astrofisica nucleare: tra stelle e acceleratori

sara.palmerini@unipg.it



Ambiti di ricerca

Astrofisica Nucleare

Astroparticelle e Astrofisica delle Alte energia

Scienze e tecnologie per lo spazio

Onde Gravitazionali e Astrofisica Multimessenger, Scienza e Tecnologia

Fisica Sperimentale delle Interazioni Fondamentali

Fisica Teorica delle Interazioni Fondamentali

Nanoscienze

Energy harvesting e ICT

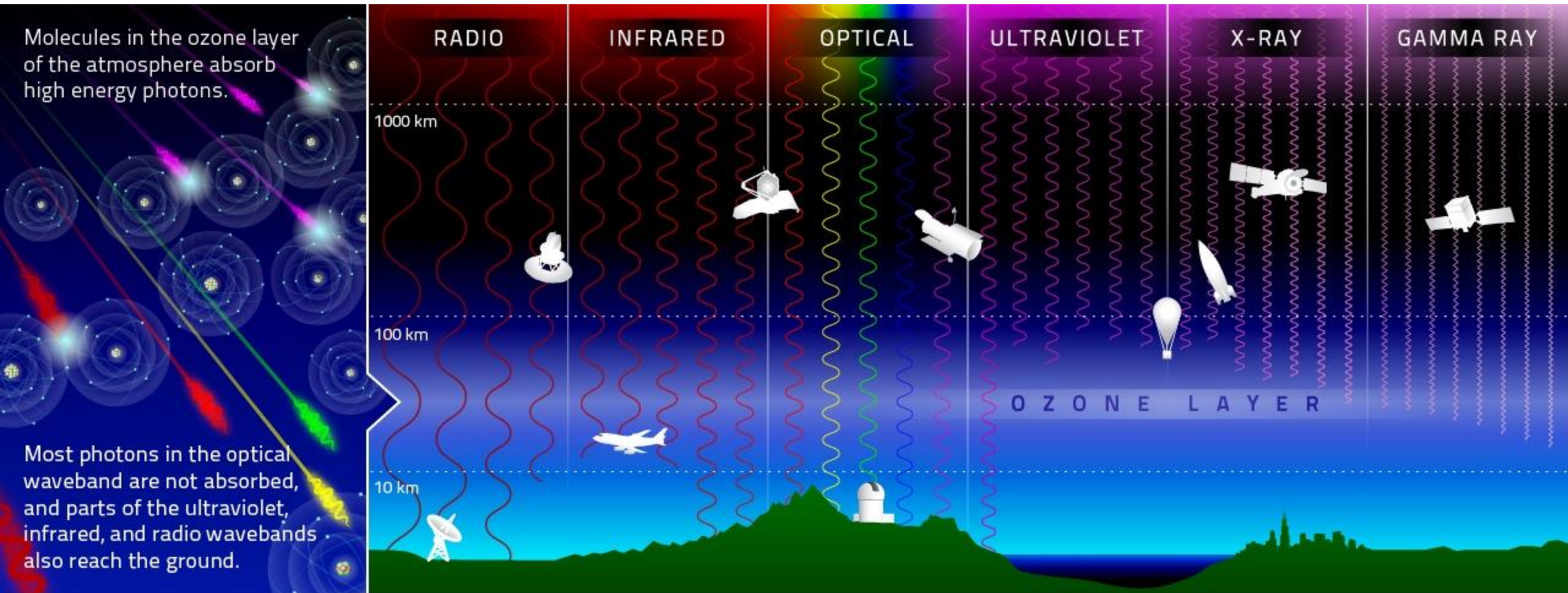
Fisica delle Biomolecole e dei Materiali Avanzati per Terapia

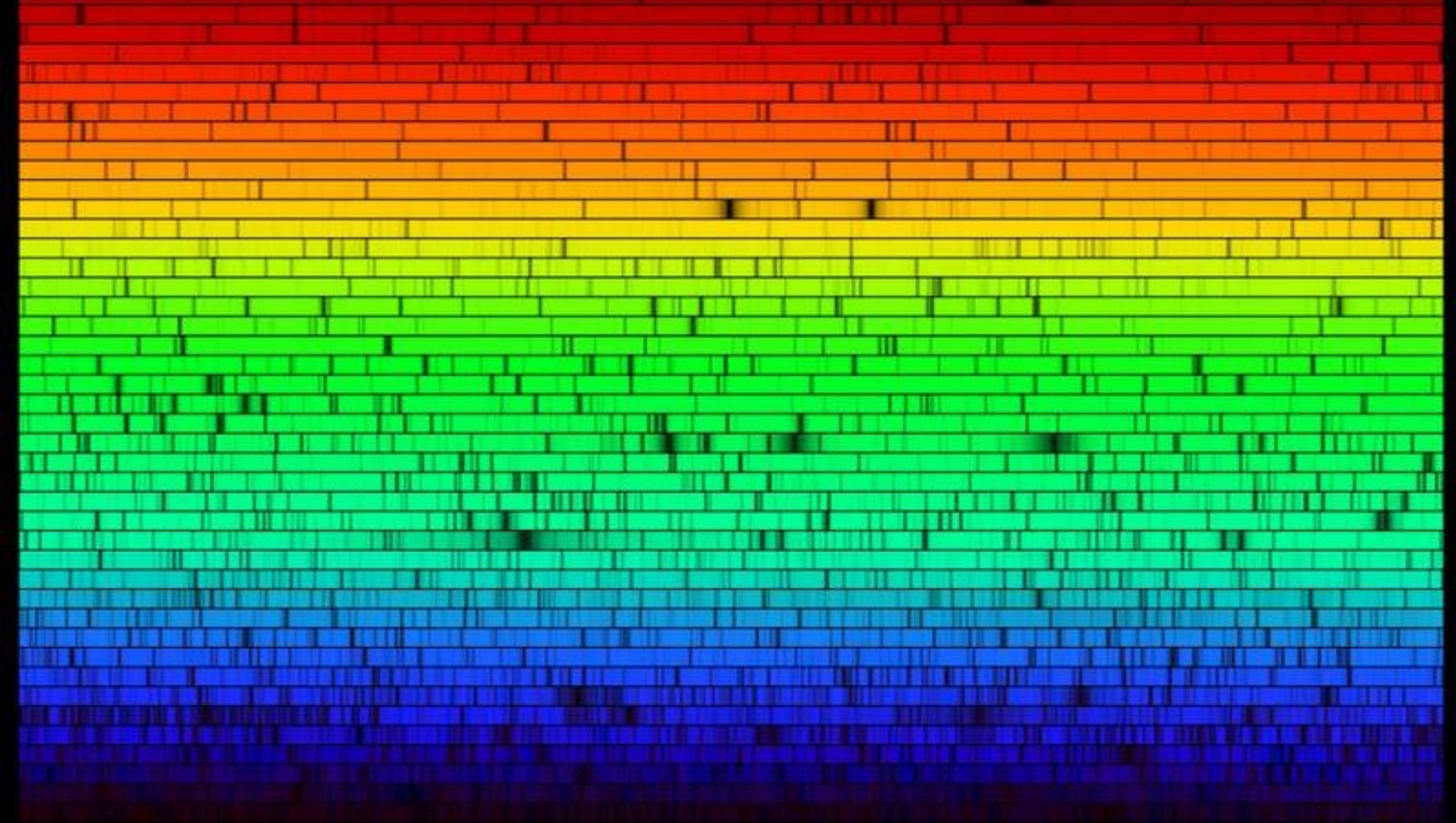
Spettroscopia neutronica, di luce di sincrotrone e free electron lasers (FEL)

Fisica della Materia Soffice

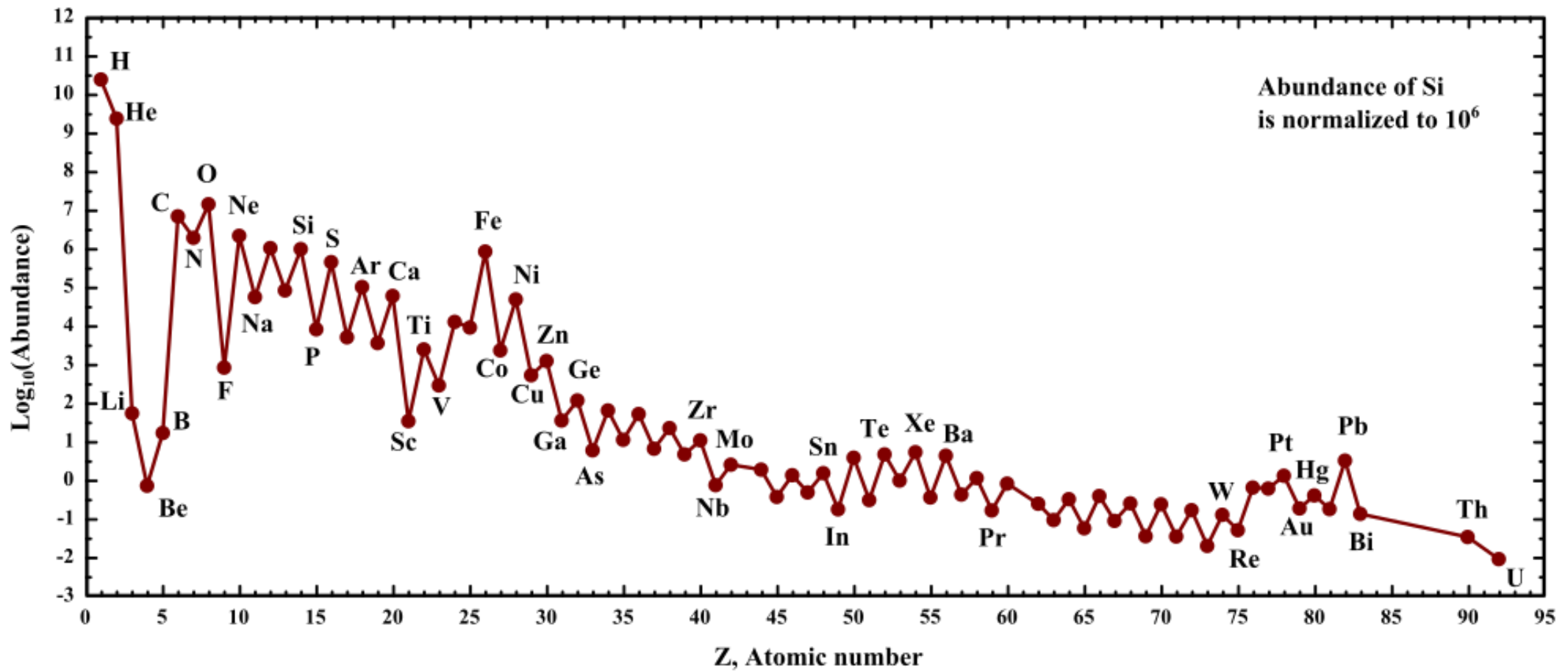
Data Science e infrastrutture per Big Data

Spettro elettromagnetico



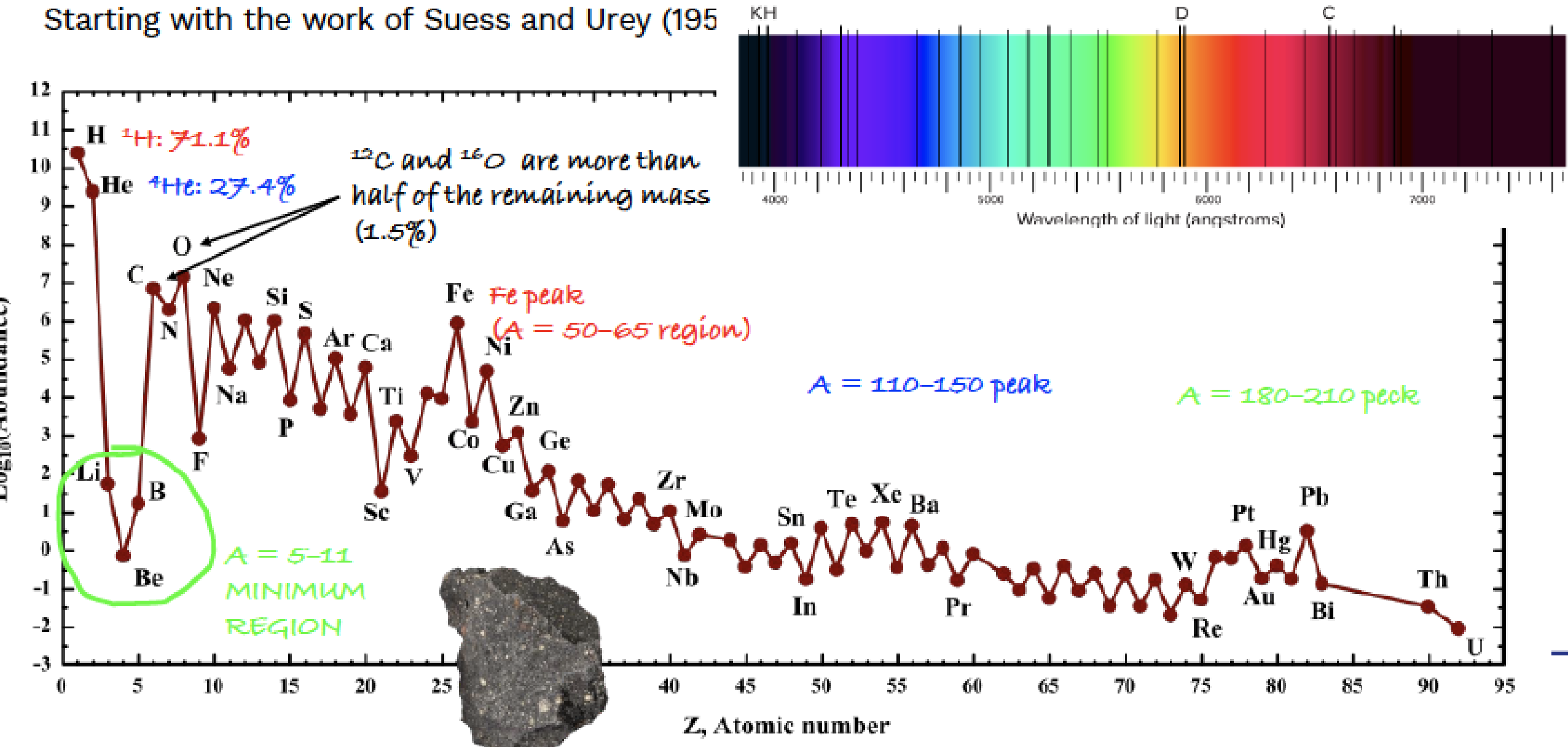


Spettro solare nel visibile



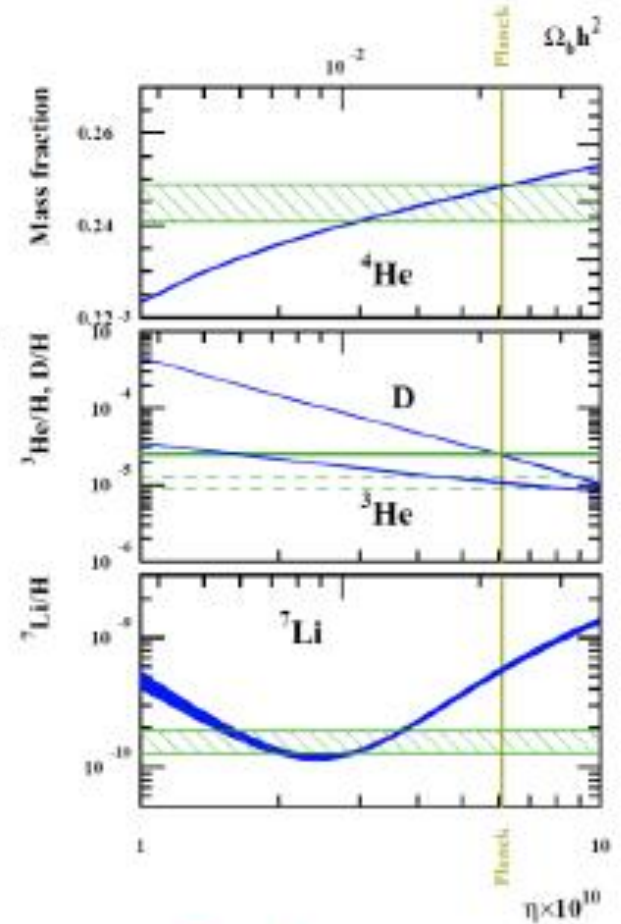
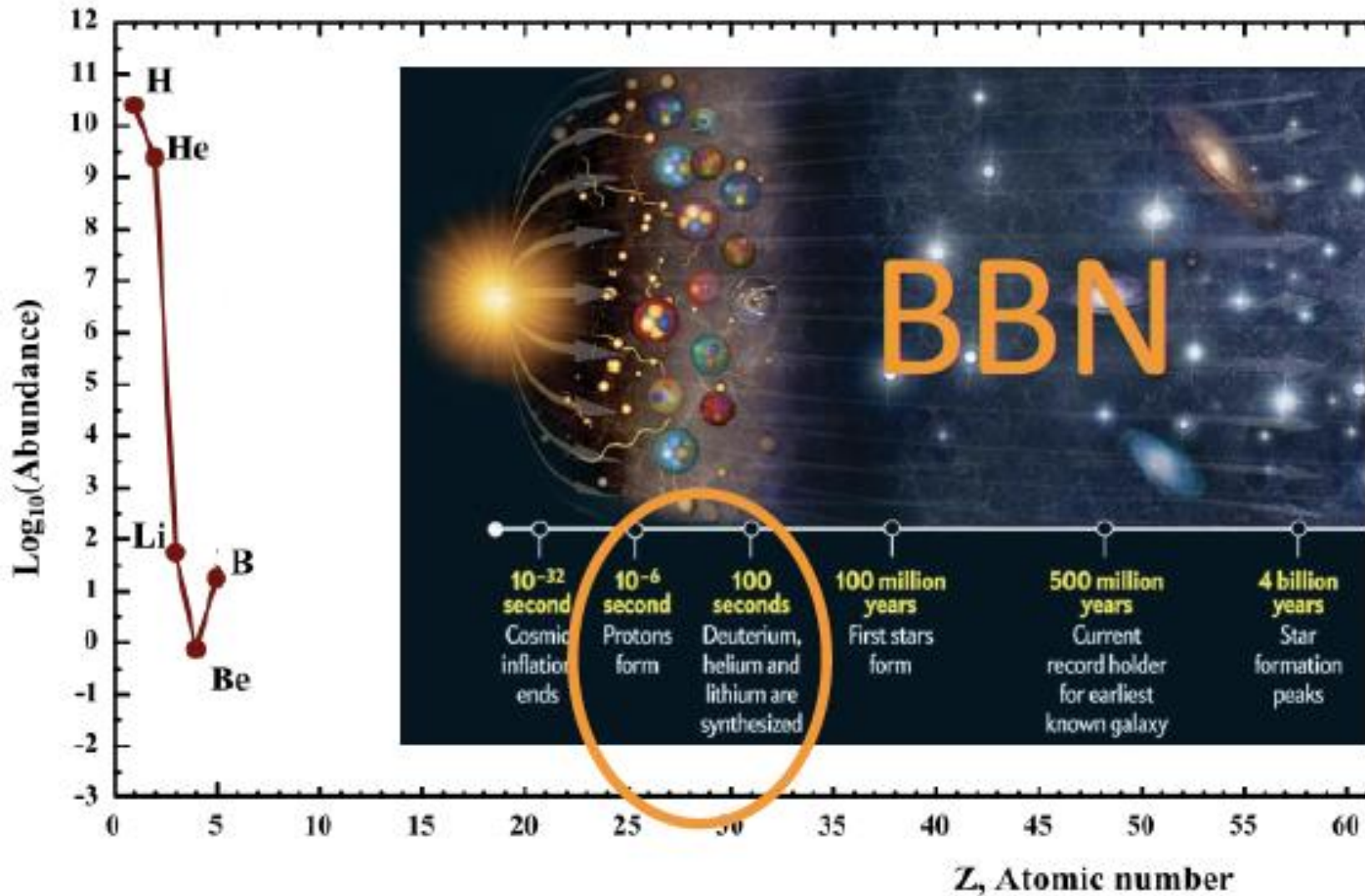
Solar System Abundances

Starting with the work of Suess and Urey (195

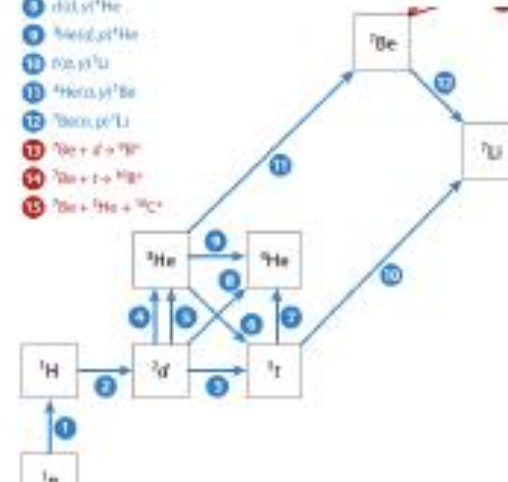


Solar System Abundances

Starting with the work of Suess and Urey (1956)....



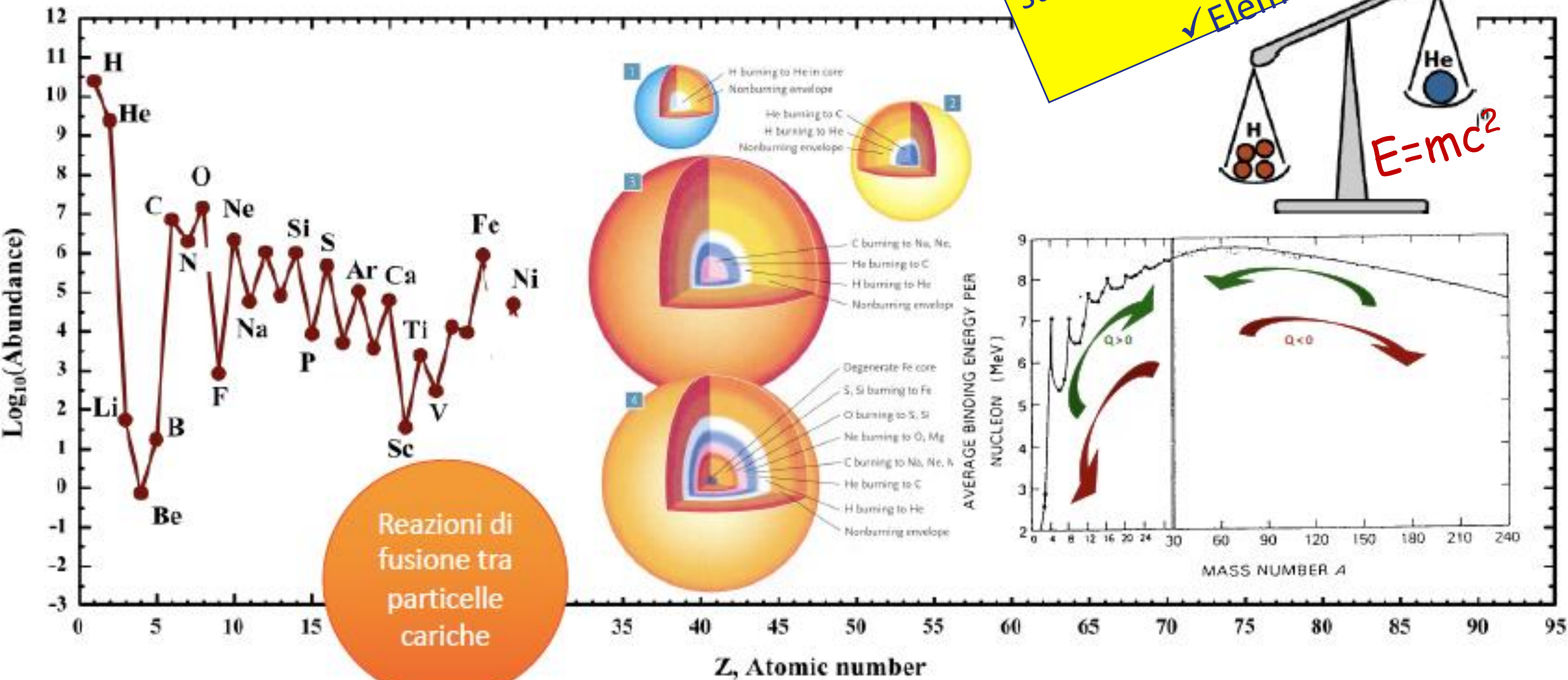
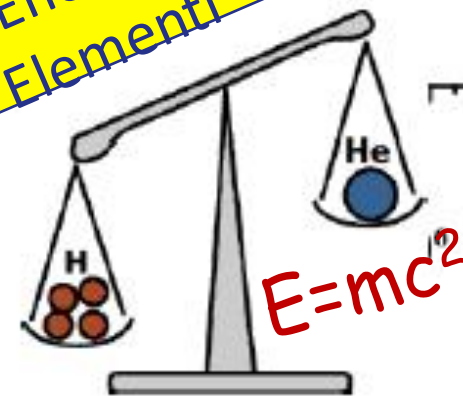
1. $n \rightarrow p + \bar{\nu}_e$
2. $n\bar{p}$ annihilation
3. e^+e^- annihilation
4. $e^+e^- \rightarrow \gamma\gamma$
5. $e^+e^- \rightarrow \nu\bar{\nu}$
6. $\bar{\nu}_e \rightarrow e^+ + \gamma$
7. $\nu_e \rightarrow e^- + \gamma$
8. $e^+e^- \rightarrow \gamma\gamma$
9. $\bar{\nu}_e \rightarrow e^+ + \gamma$
10. $\nu_e \rightarrow e^- + \gamma$
11. $\bar{\nu}_e \rightarrow e^+ + \gamma$
12. $\nu_e \rightarrow e^- + \gamma$
13. $^2\text{H} + p \rightarrow ^3\text{He} + \gamma$
14. $^2\text{H} + n \rightarrow ^3\text{H} + \gamma$
15. $^2\text{H} + ^2\text{H} \rightarrow ^4\text{He} + \gamma$



Solar System Abundances

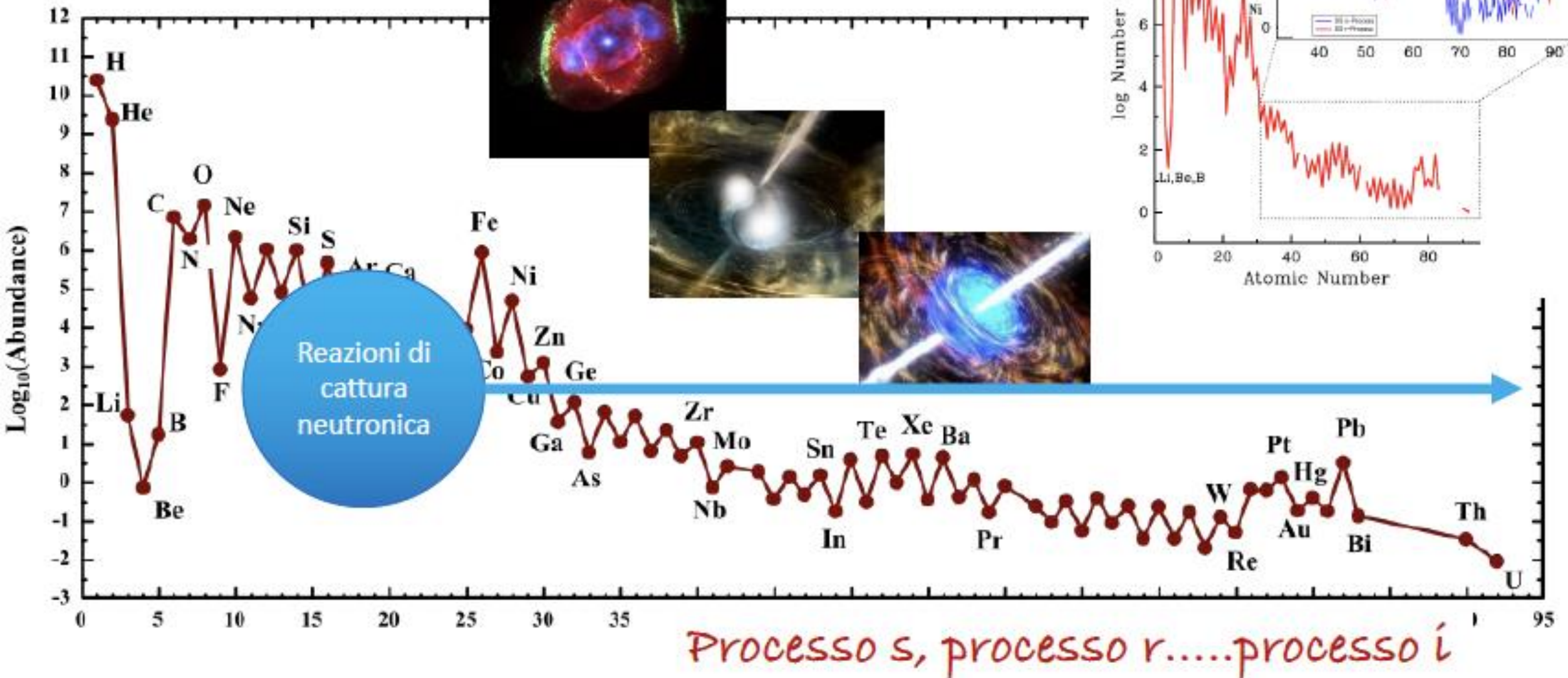
Starting with the work of Suess and Urey (1956)....

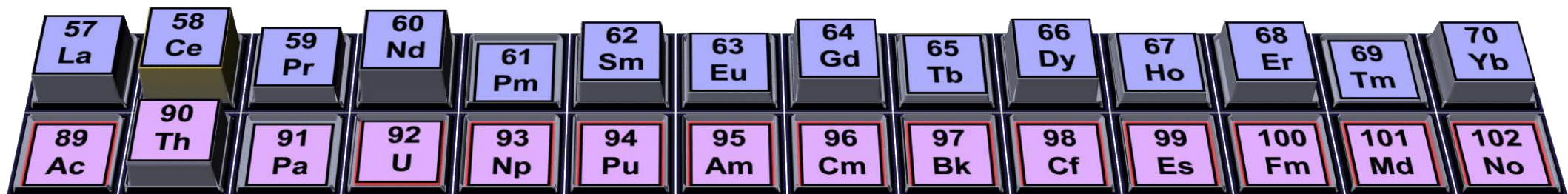
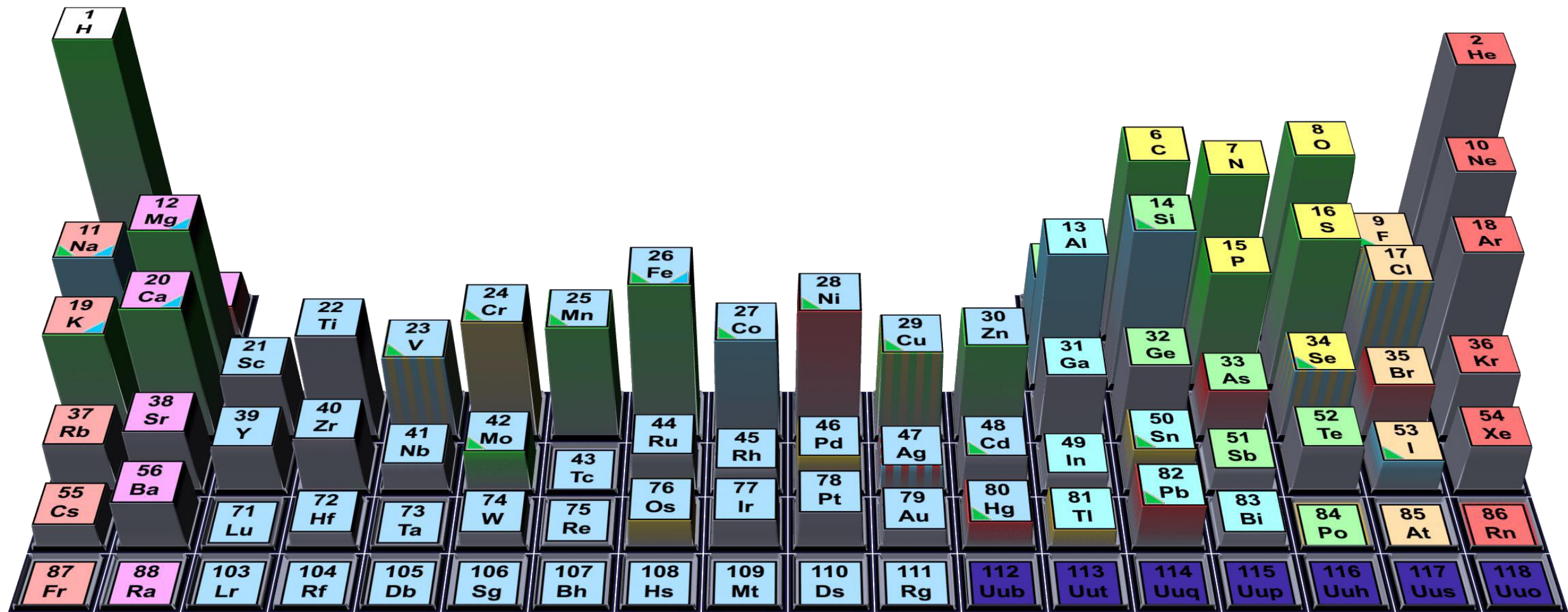
Le reazioni nucleari nelle stelle producono:
 ✓ Energia
 ✓ Elementi



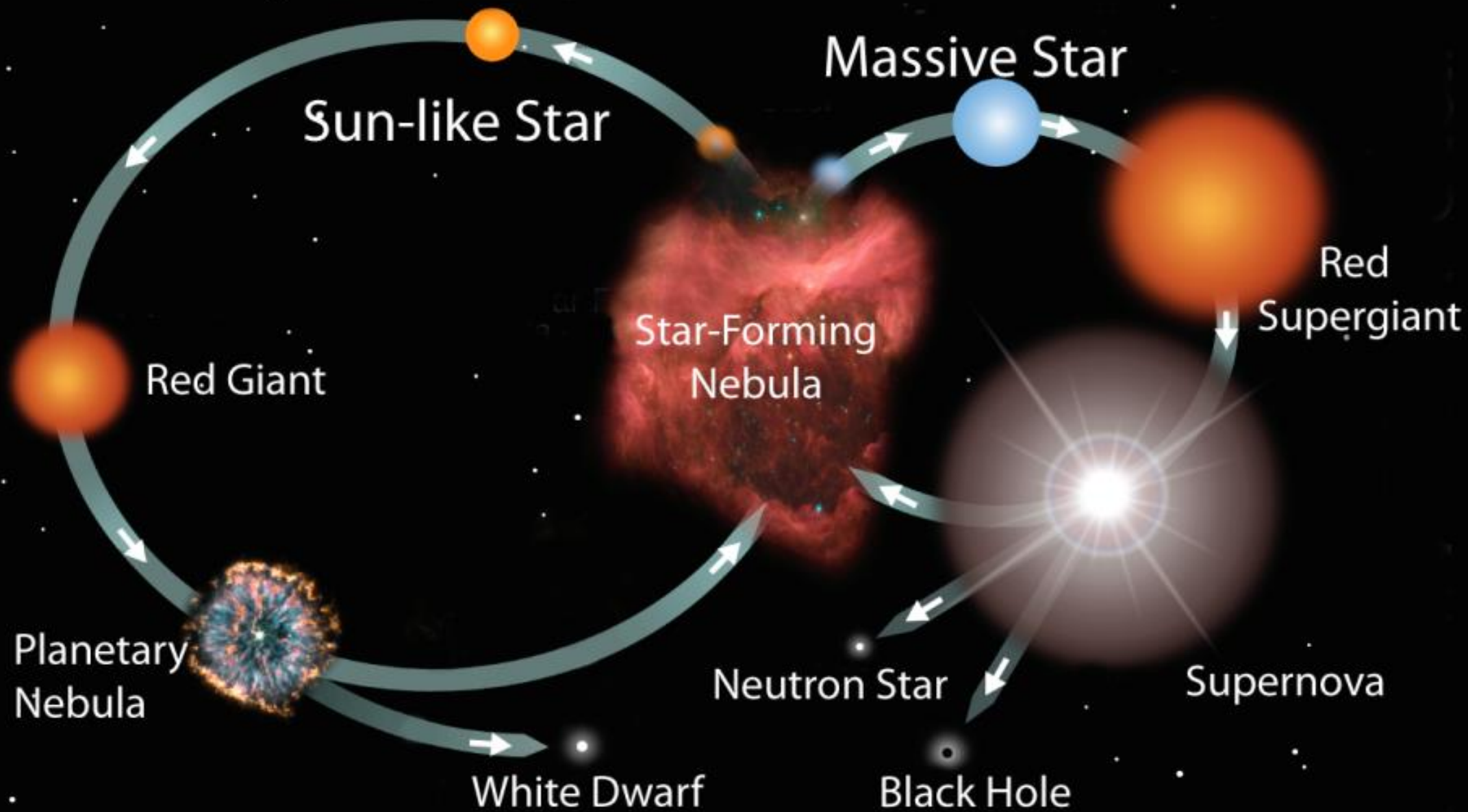
Solar System Abundances

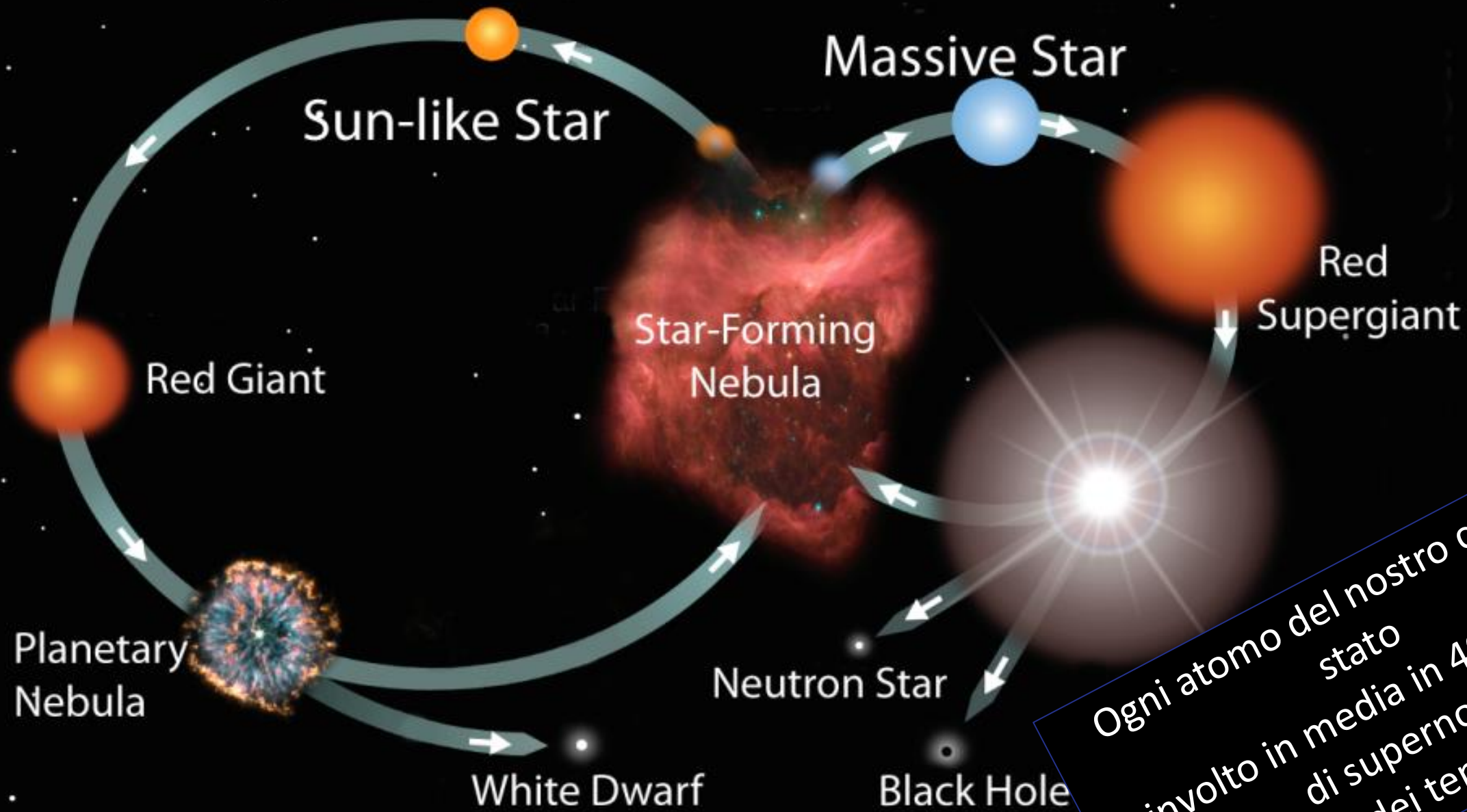
Starting with the work of Su (1956)....





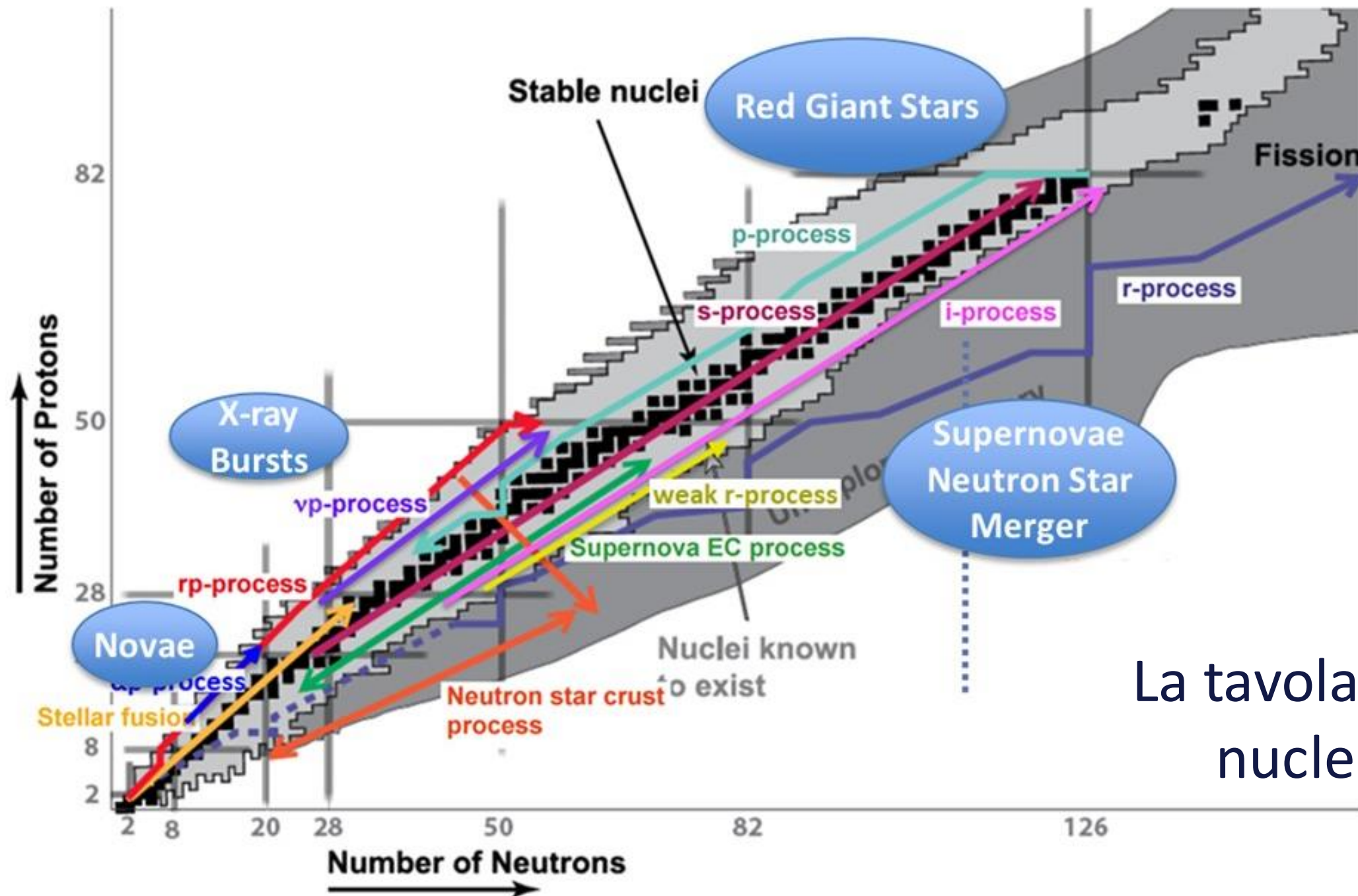
1 H	PERIODIC TABLE - ORIGIN OF ELEMENTS																2 He
3 Li	4 Be	■ Big Bang nucleosynthesis ■ Exploding white dwarfs ■ Dying low-mass stars ■ Merging neutron stars ■ Exploding massive stars										5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi			
		58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu		
		90 Th															92 U





Ogni atomo del nostro corpo è
stato
coinvolto in media in 40 esplosioni
di supernova
dall'inizio dei tempi ad oggi!

1 H	PERIODIC TABLE - ORIGIN OF ELEMENTS																2 He
3 Li	4 Be	■ Big Bang nucleosynthesis ■ Exploding white dwarfs ■ Dying low-mass stars ■ Merging neutron stars ■ Exploding massive stars										5 B	6 C	7 N	8 O	9 F	10 Ne
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37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi			
		58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu		
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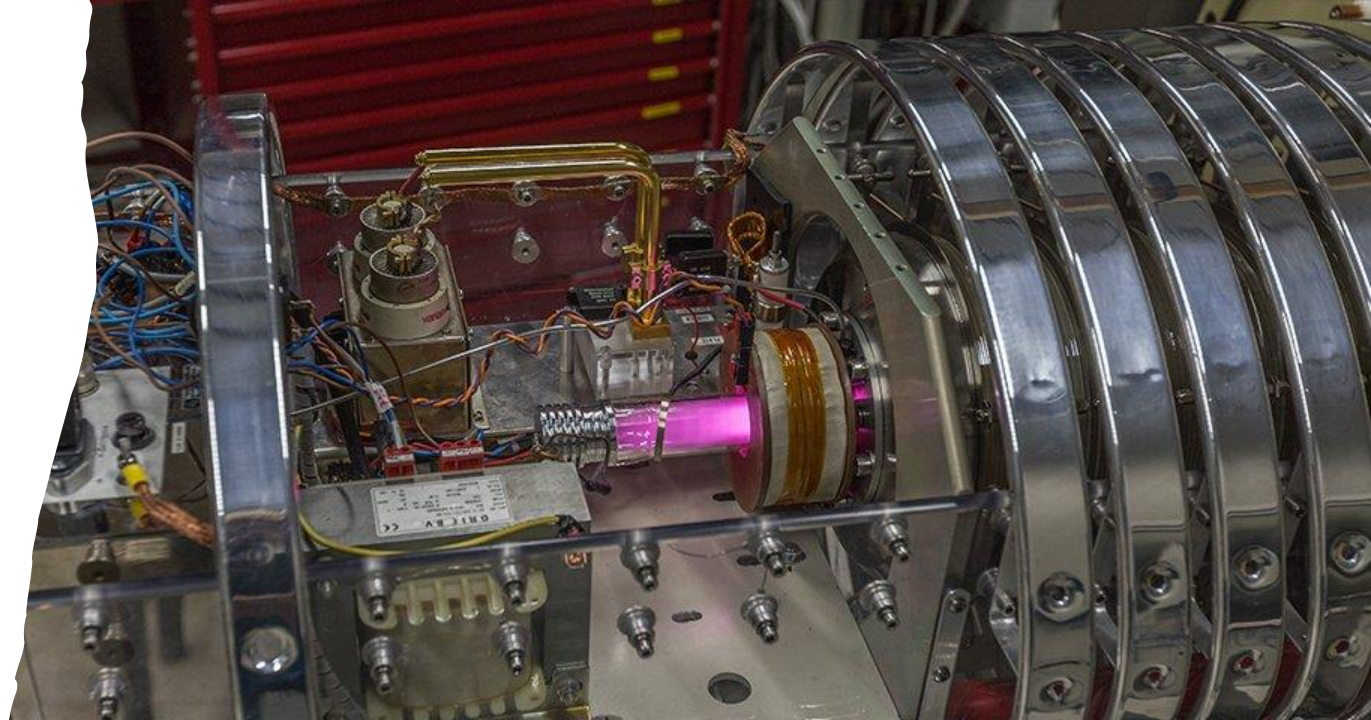


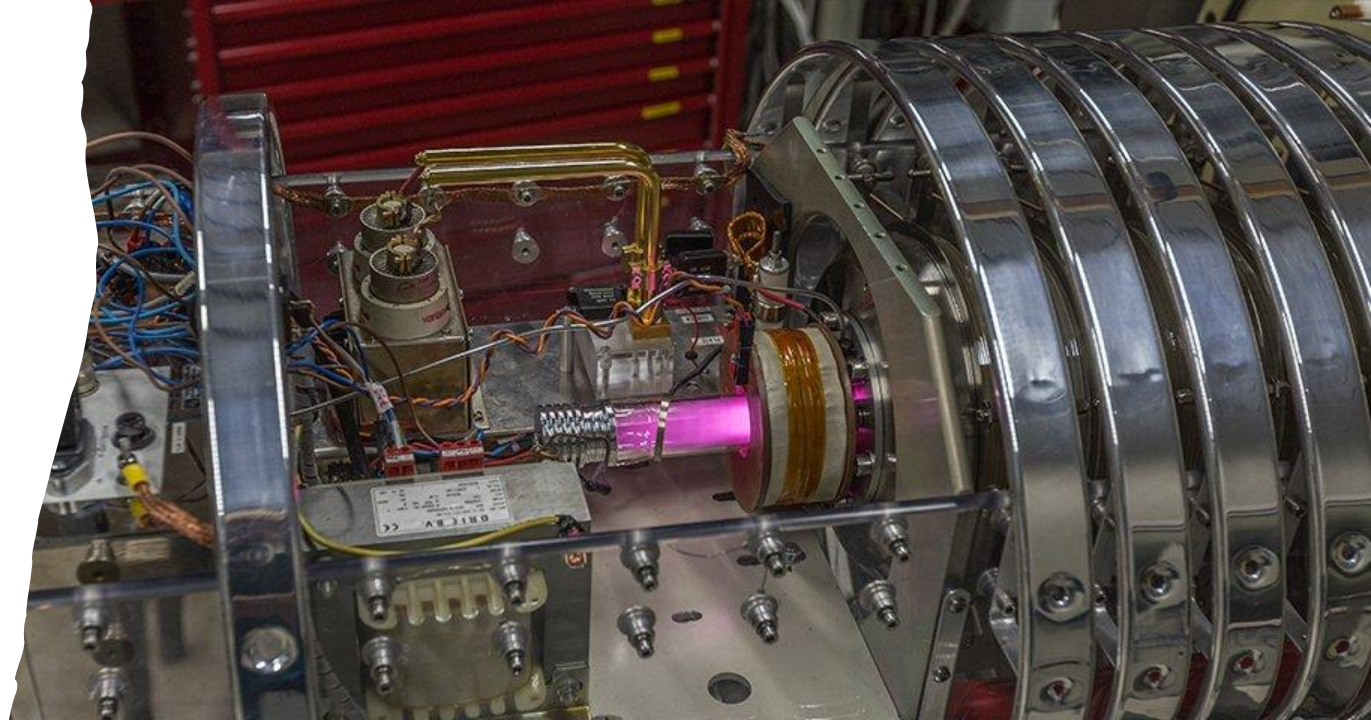
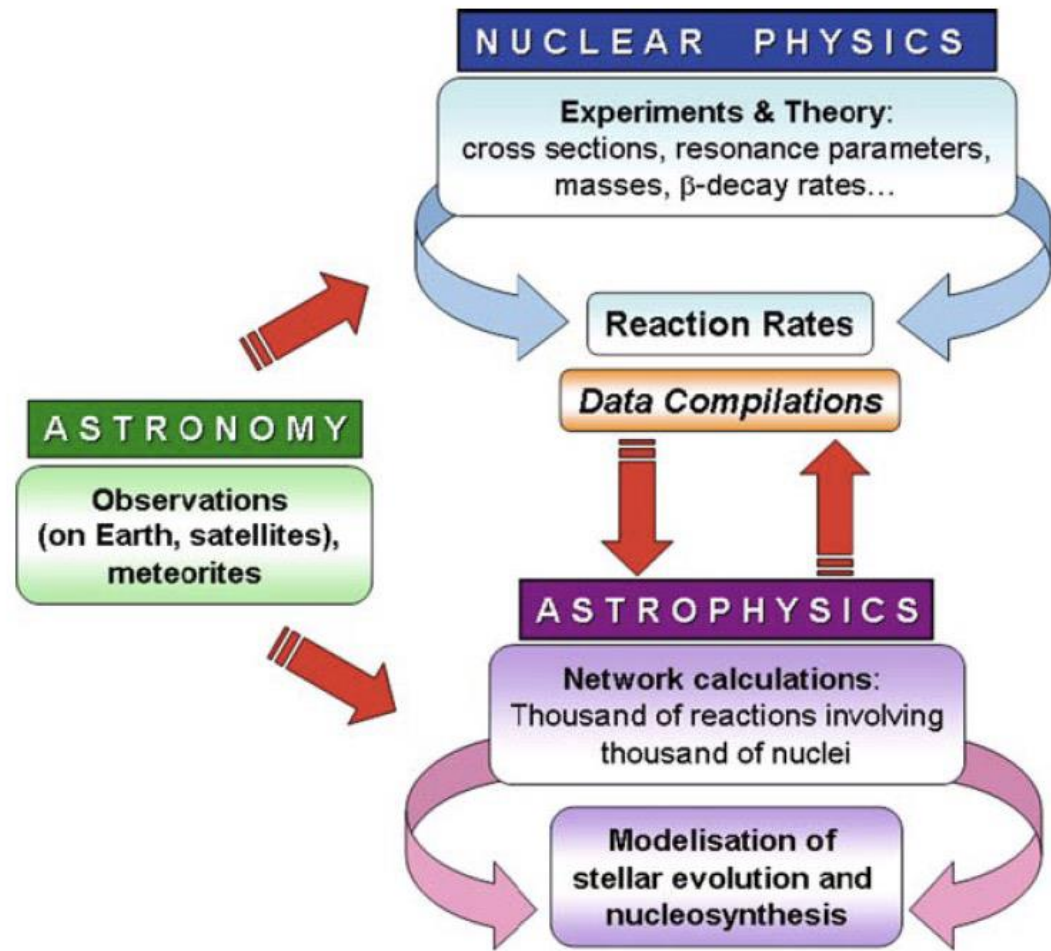
La tavola dei nuclei

$$E_k = 1/2mv^2$$

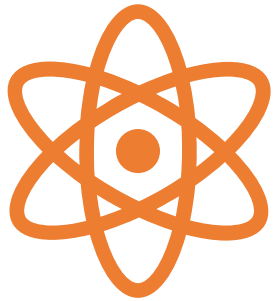
$$E = 3/2k_B T$$

$$E = h\nu$$





Corsi su tematiche attinenti



Astrofisica Nucleare

(2 semestre 3°LT/1°LM, S. Palmerini)

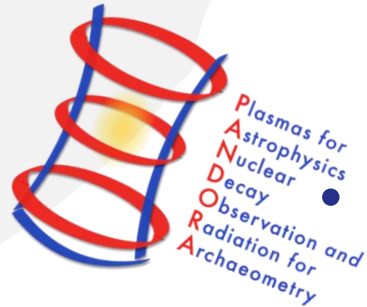


Fisica del Sistema Solare

(1 semestre 3°LT, M. Busso/S. Palmerini)



Proposte di tesi



- Misura della sezione d'urto delle reazioni $^{17}\text{O}(\alpha, n)^{20}\text{Ne}$: una sorgente di neutroni alternativa nelle stelle
- Misura della sezione d'urto delle reazioni $^{19}\text{F}(p, \alpha)^{15}\text{N}$: quando si chiude il ciclo CNO?
- Modelli di nucleosintesi stellare di ^{19}F , ^{26}Al , ^{23}Na per determinarne la sorgente galattica
- Nucleosintesi ad $A > 150$: le incertezze nucleari dovute all'interazione debole



Nucleosintesi da cattura neutronica: esiste il processo i?

Astrofisica nucleare: tra stelle e acceleratori

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