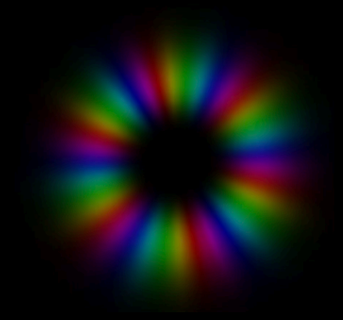
UNIVERSITÀ DI TRENTO
Dipartimento di Fisica



Fisica e chimica a braccetto

[la fabbrica quantistica delle meraviglie]

ELEMENTI di FISICA MODERNA

[e intelligenza artificiale] 2025

Il punto di partenza:

bussole, calamite, atomi e

QUANTIZZAZIONE

SPAZIALE

Bohr quantizza il

MOMENTO ANGOLARE

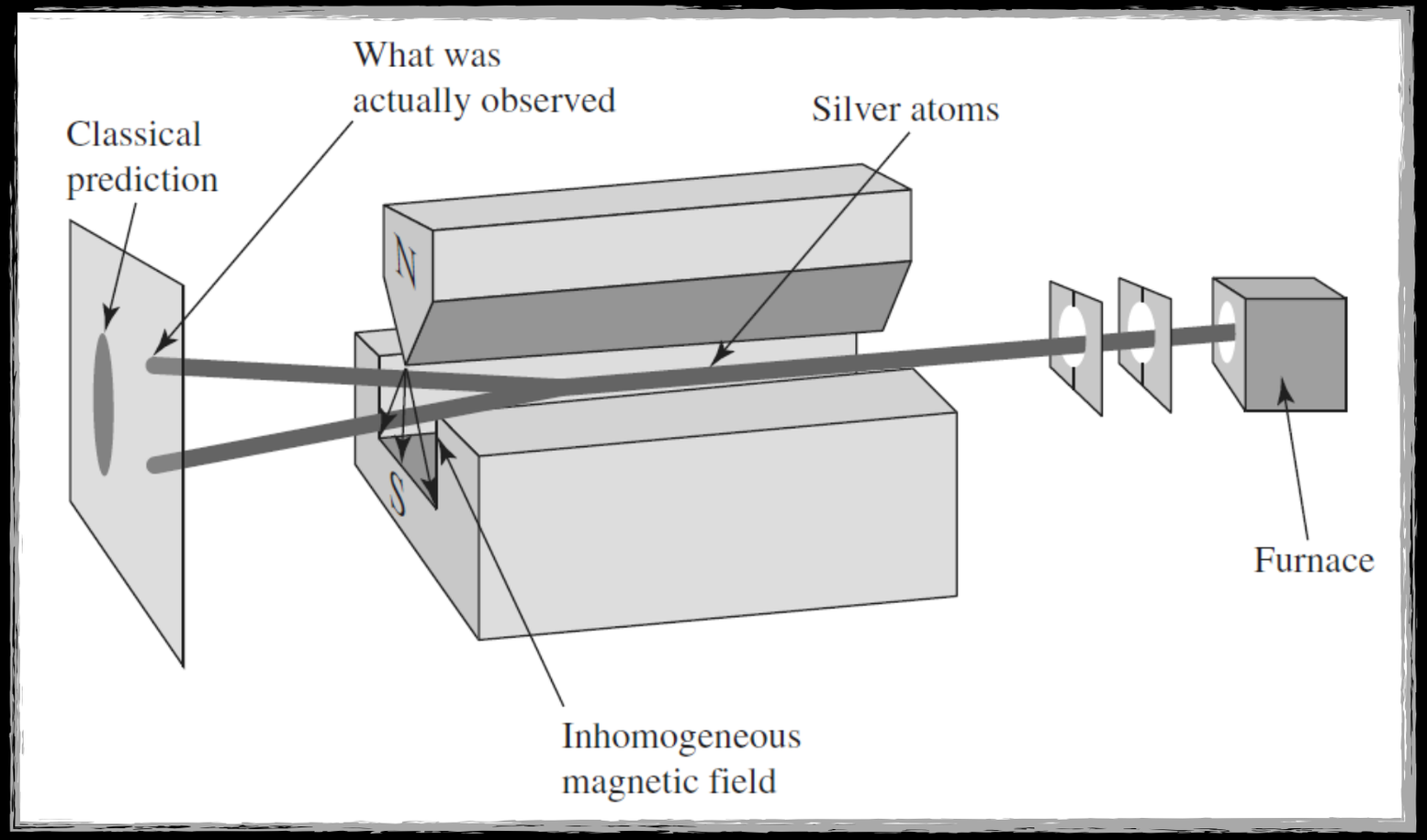
La «trottola atomica» è una bussola magnetica:

deve allinearsi a un campo magnetico esterno

Esperimento di Stern-Gerlach

1922
N 1925

[a caccia del momento angolare
e del dipolo - bussola atomico]



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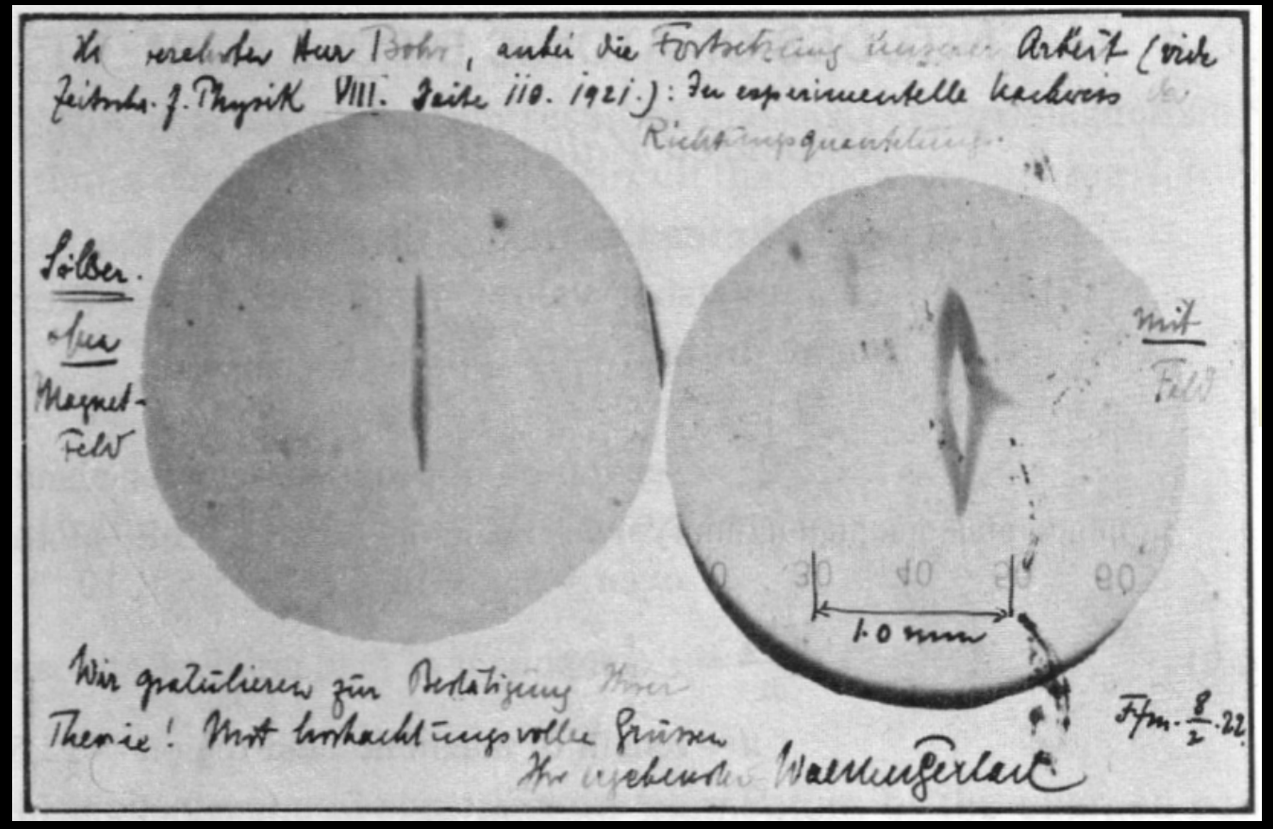

L'elettrone «vive» in

due stati magnetici

HA «SPIN» 1/2

è una «calamita a scatti»

L'elettrone « vive » in
due stati magnetici

HA « SPIN » 1/2

è una « calamita a scatti »

MA NON HA DIFFERENTI
VERSI di ROTAZIONE
PERCHÉ NON C'È NULLA
CHE RUOTA !

Il mondo è fatto da

FERMIONI BOSONI

spin

semi-intero intero

PRINCIPIO di ESCLUSIONE

[W. Pauli - 1925 - N.1945]

due fermioni identici non possono occupare lo stesso « stato »

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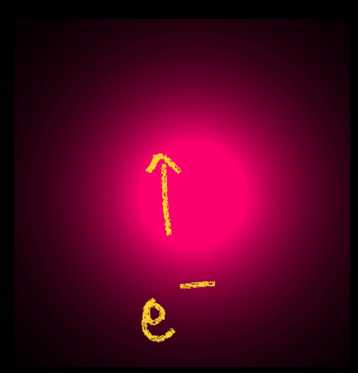

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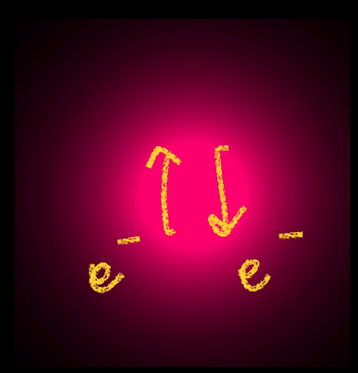

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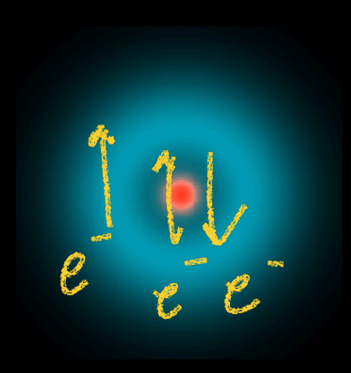
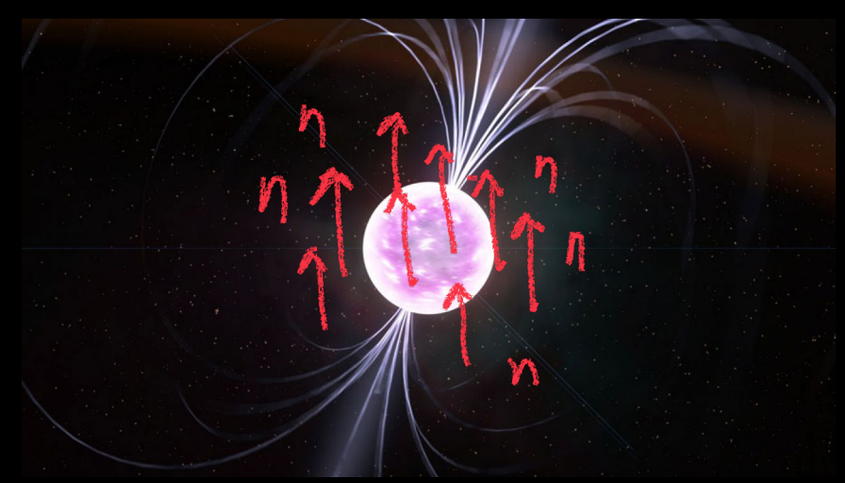
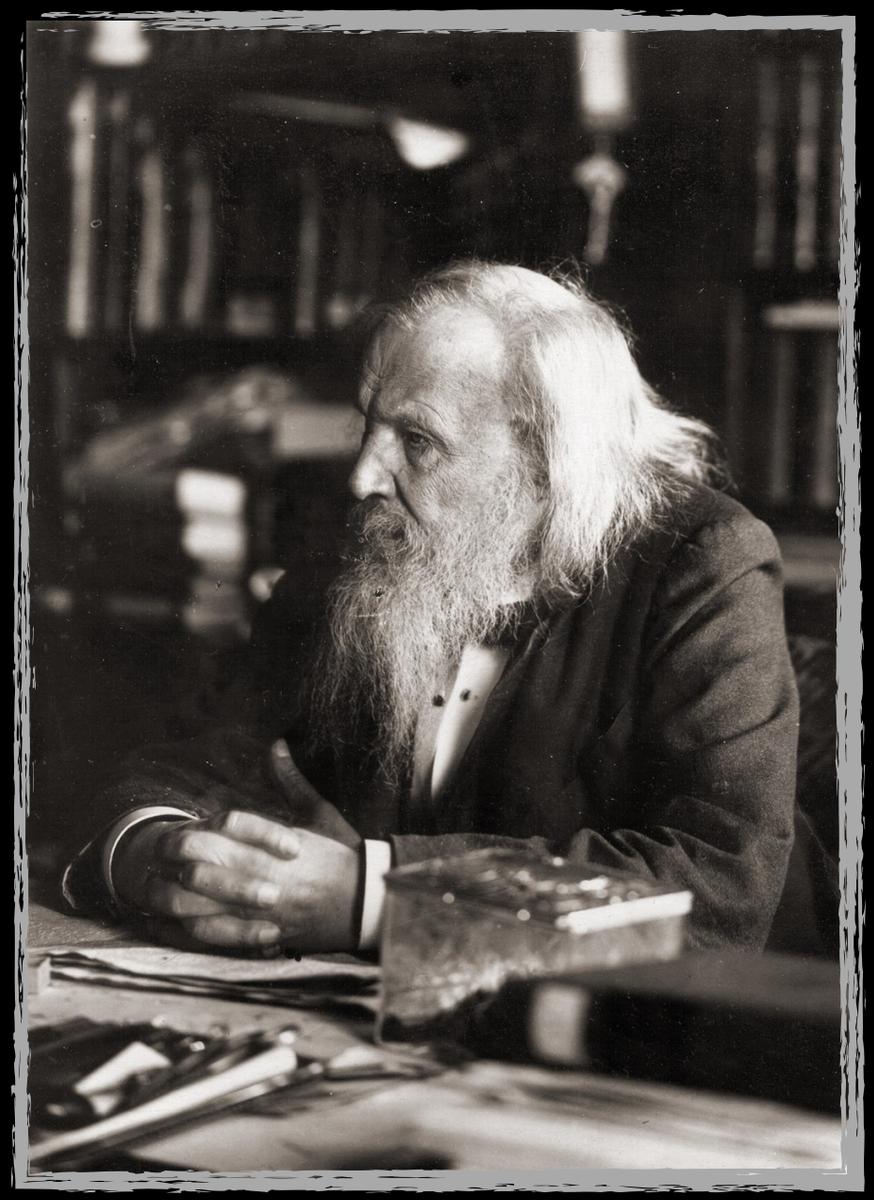


Li



stella di neutroni

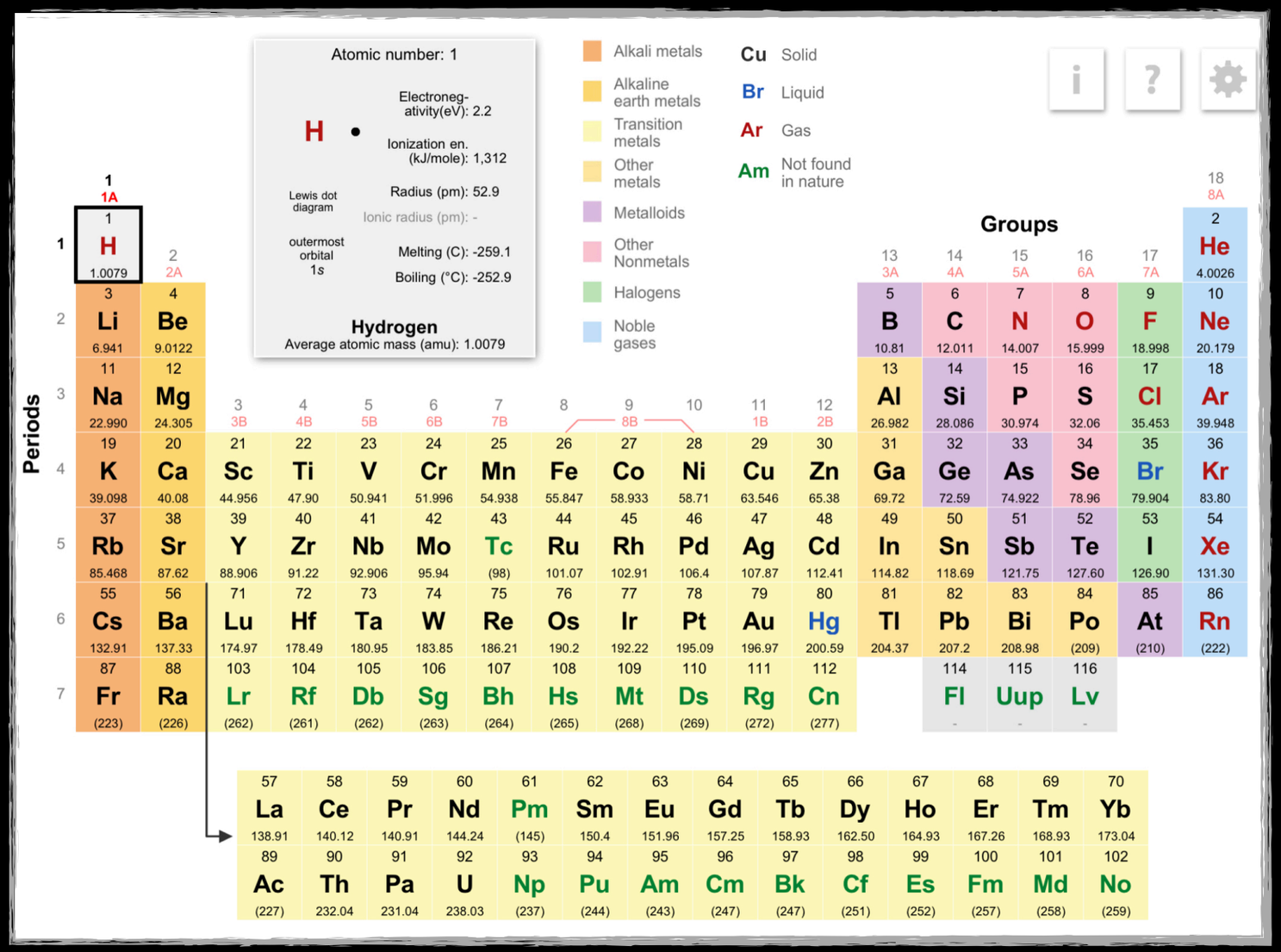
Tabella periodica degli elementi



~1860

Reihen	Gruppe I. — R^2O	Gruppe II. — RO	Gruppe III. — R^2O^3	Gruppe IV. RH^4 RO^2	Gruppe V. RH^3 R^2O^5	Gruppe VI. RH^2 RO^3	Gruppe VII. RH R^2O^7	Gruppe VIII. — RO^4
1	H=1							
2	Li=7	Be=9,4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27,3	Si=28	P=31	S=32	Cl=35,5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56, Co=59, Ni=59, Cu=63
5	(Cu=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	
12	—	—	—	Th=231	—	U=240	—	— — — —

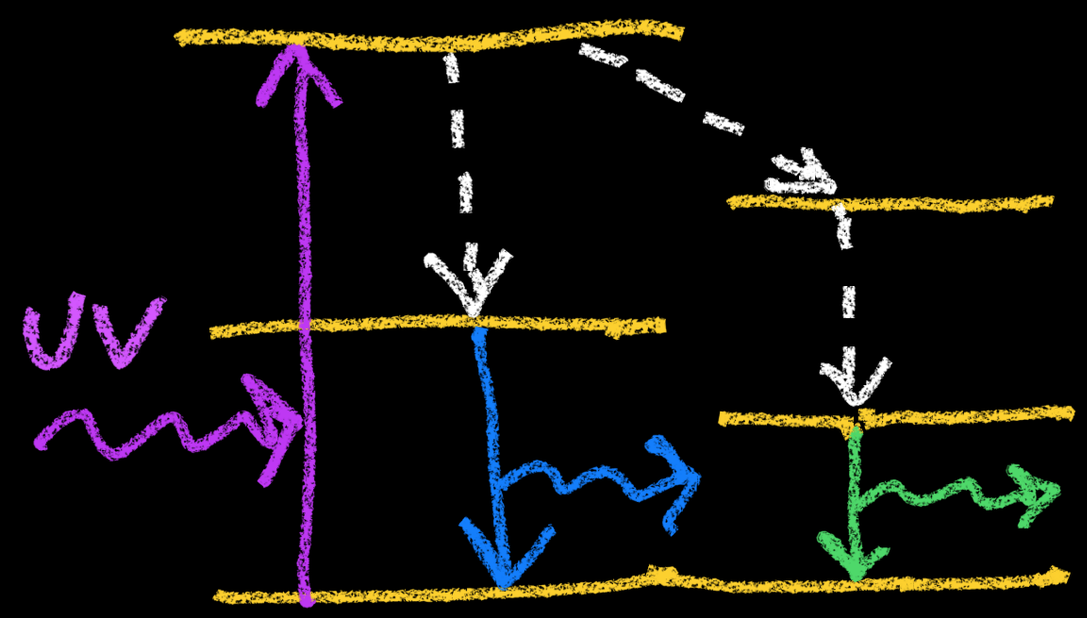
Tabella periodica degli elementi



~ 2023

Fluorescenza & Fosforoscenza:

livelli e transizioni atomiche nascoste



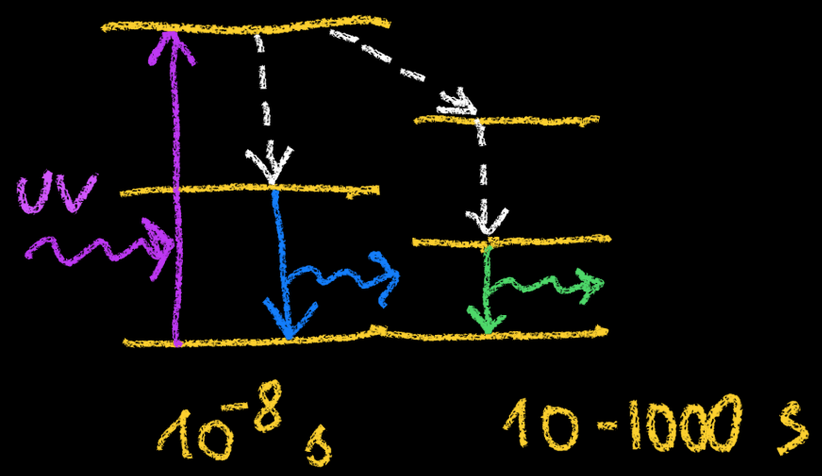
10^{-8} s

10 - 1000 s

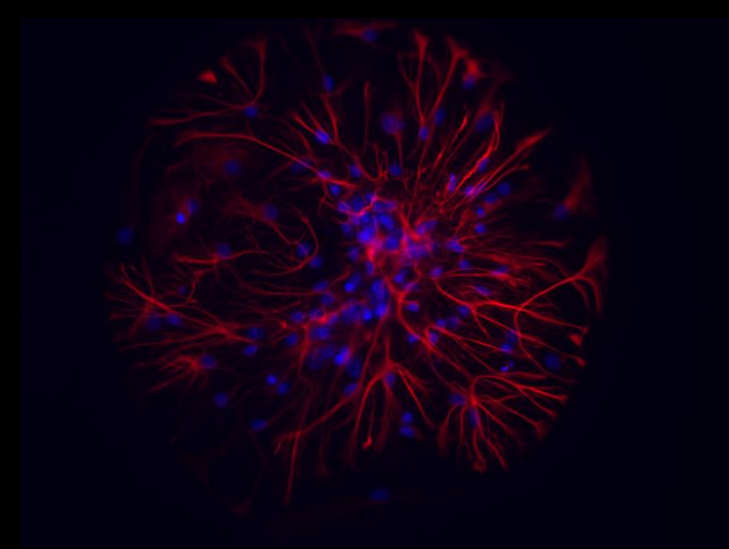
FÒSFORO
&
FOSFÒRO

Fluorescenza & Fosforoscenza:

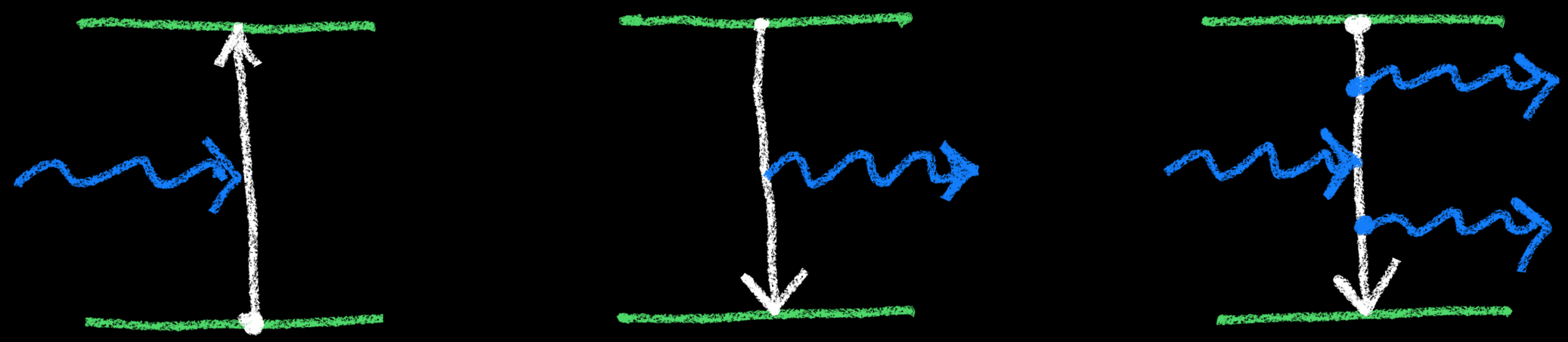
livelli e transizioni atomiche nascoste



microscopi a fluorescenza



Amplificazione di luce per emissione stimolata di radiazione



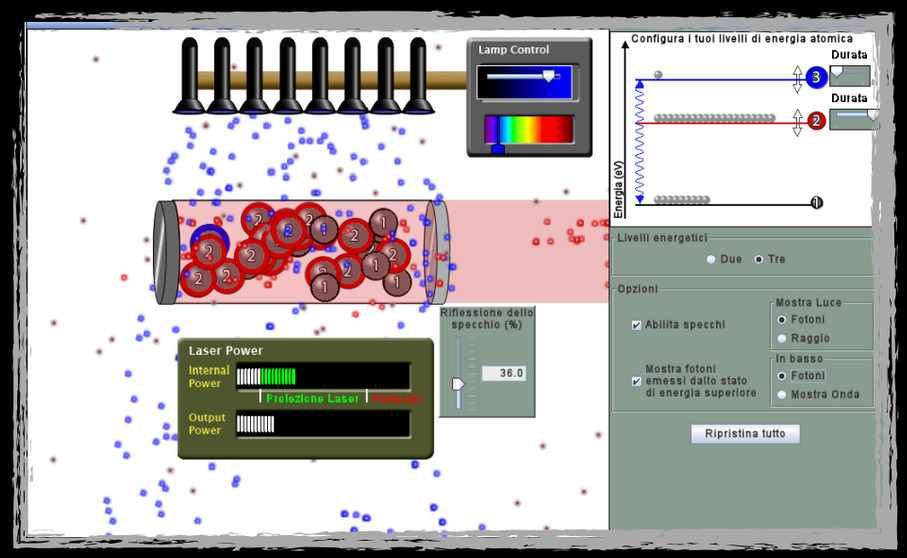
assorbimento spontaneo

emissione spontanea

emissione stimolata

Amplificazione di luce per emissione stimolata di radiazione

Light Amplification by Stimulated Emission of Radiation

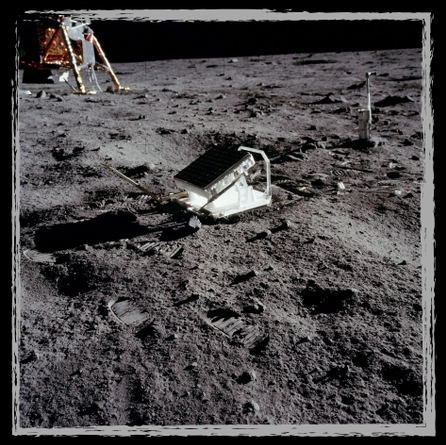


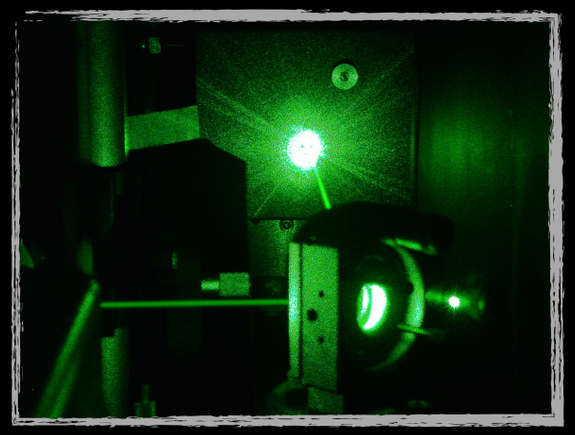
LUCE MONOCROMATICA COERENTE

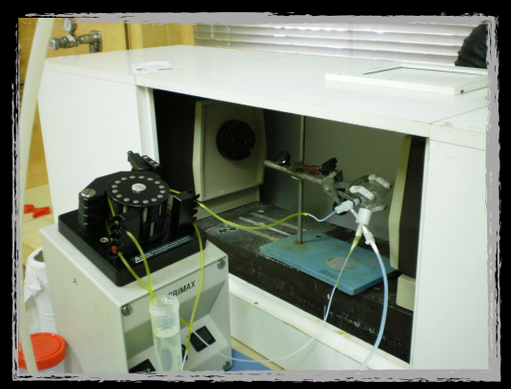
Applicazioni del LASER ?

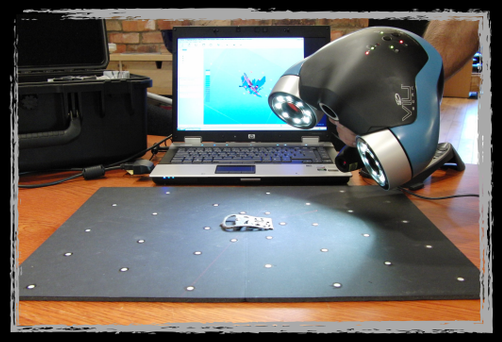
- scientifiche
- mediche
- militari
- industriali
- informatica
- comunicazione

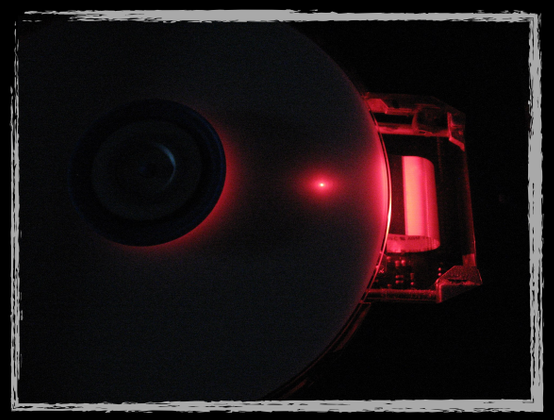
Applicazioni del LASER ?

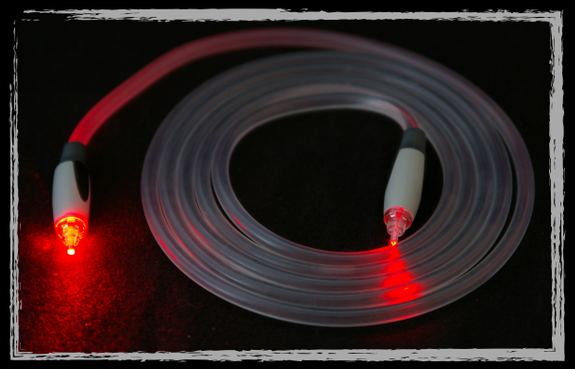












Applicazioni del LASER ?

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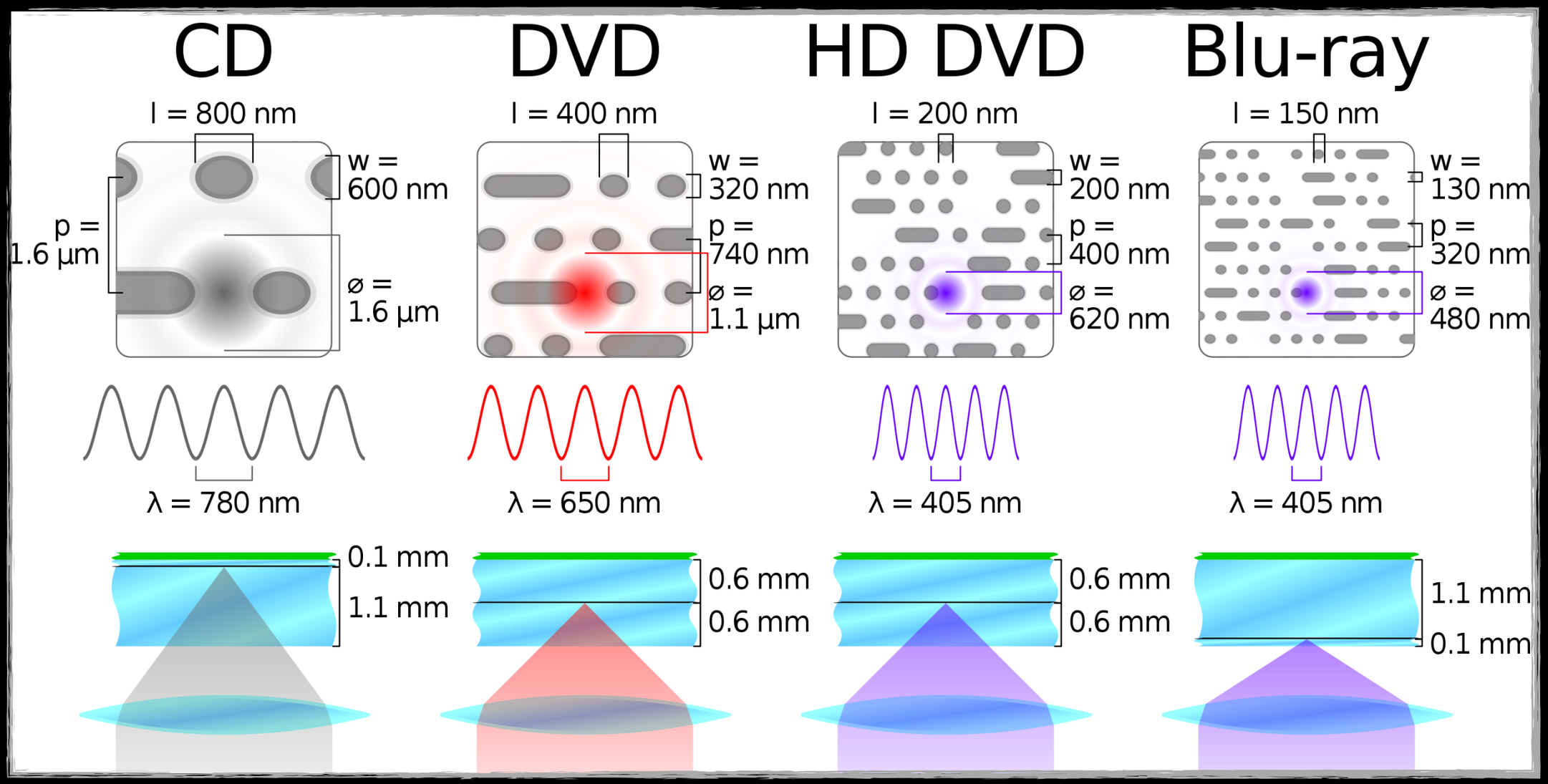
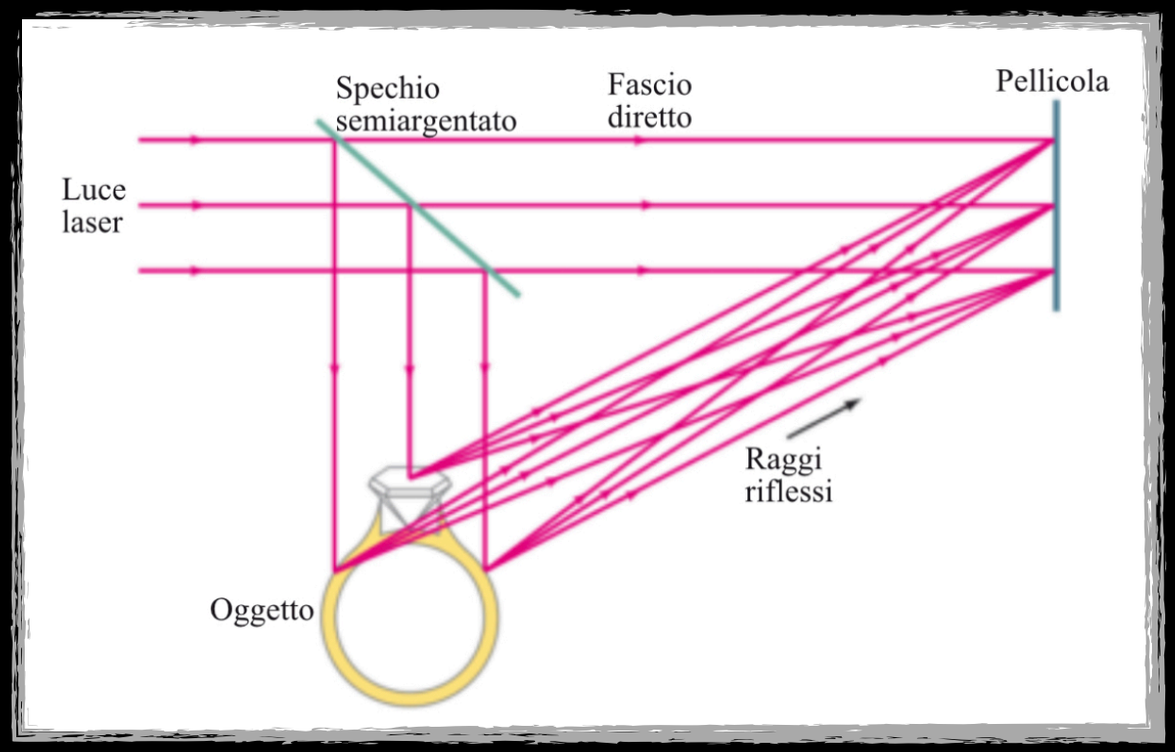
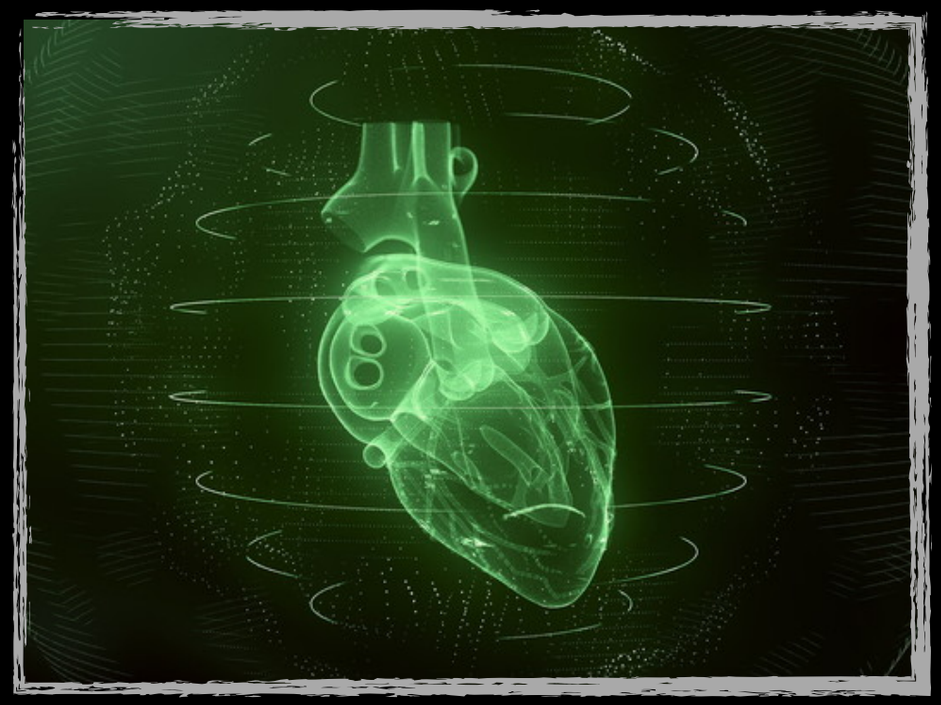


OLOGRAMMI , OLOGRAFIA

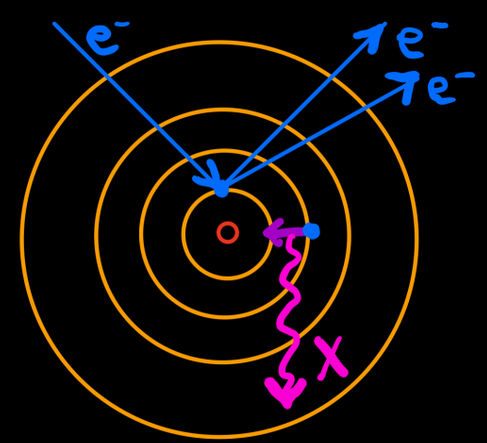


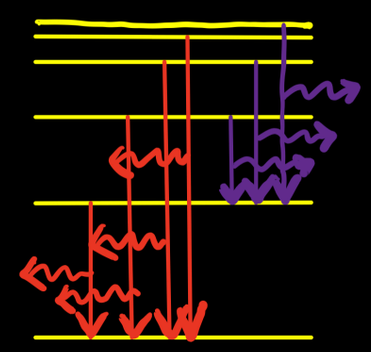


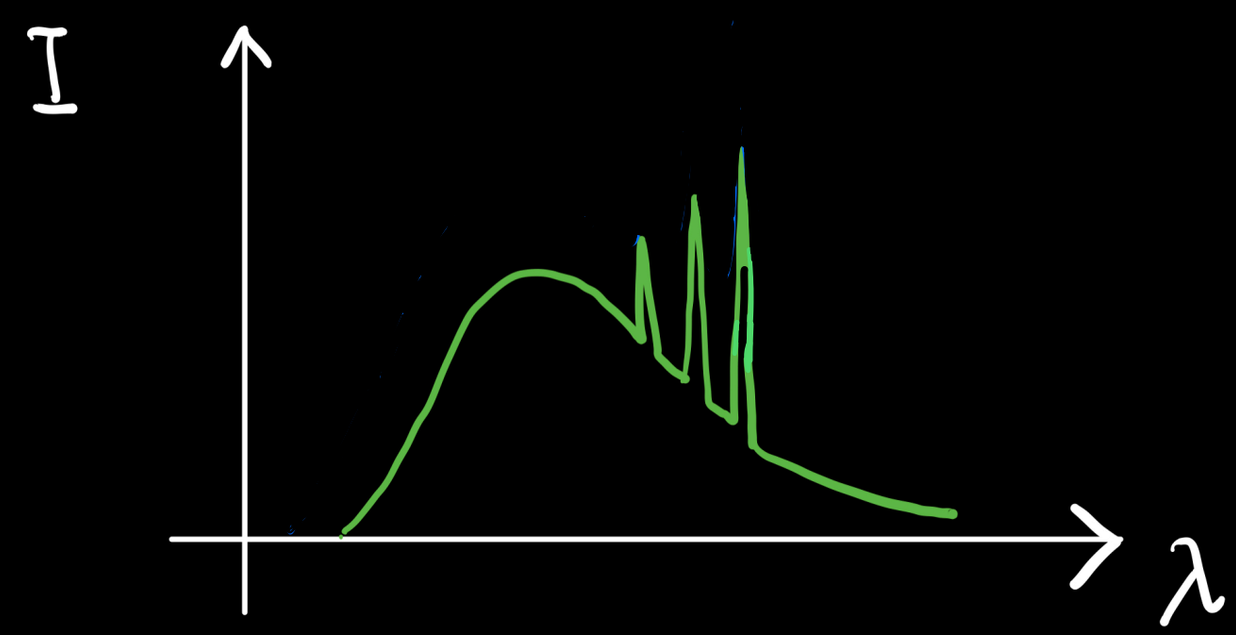
spettroscopia profonda : raggi X

dalla nascita della radioattività
alla diagnostica moderna

spettroscopia profonda : raggi X







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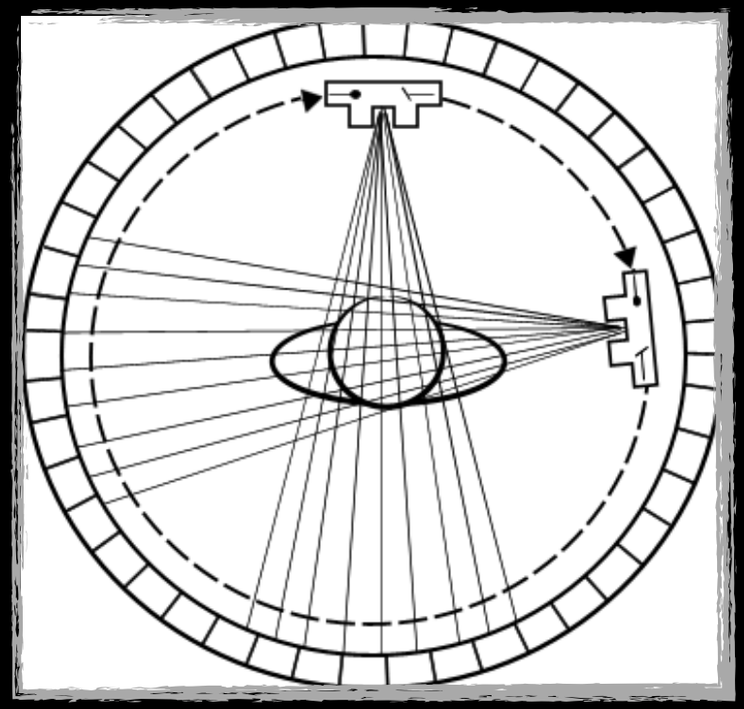

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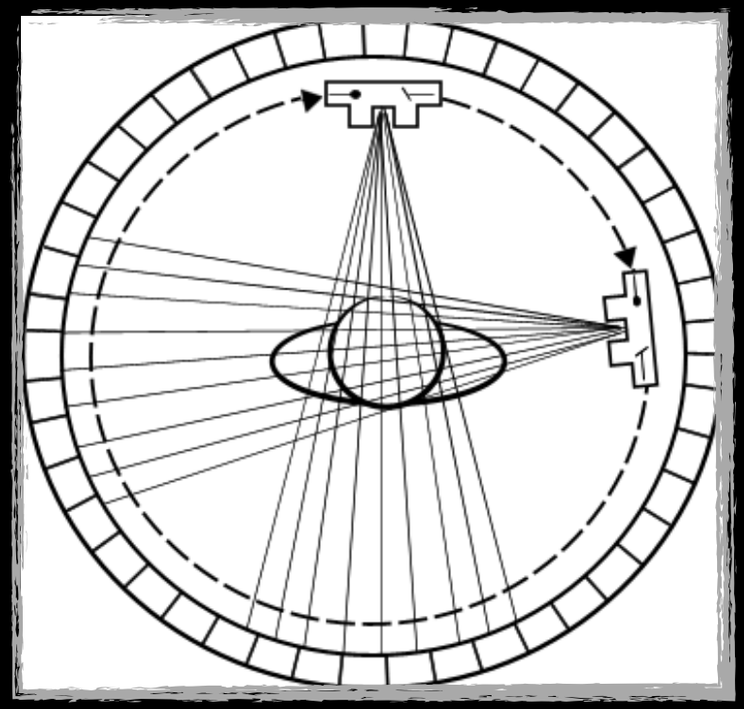

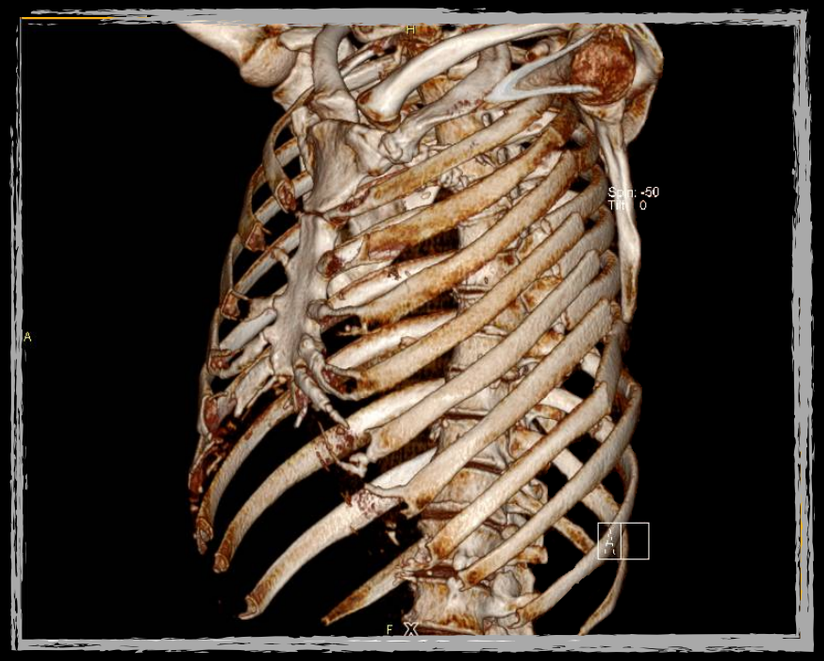

e il gioco del Lego

continua

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