



La fisica delle stelle

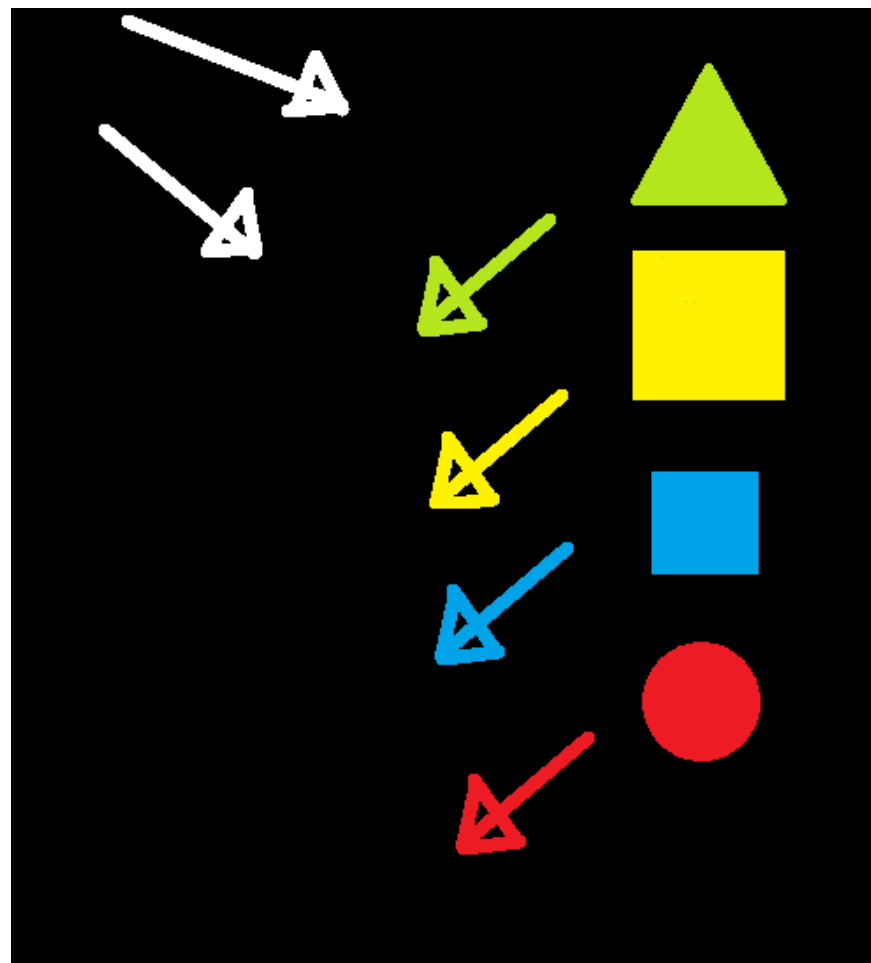
Lucio Gialanella

Dipartimento di Matematica e Fisica

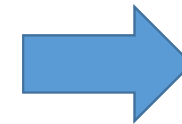
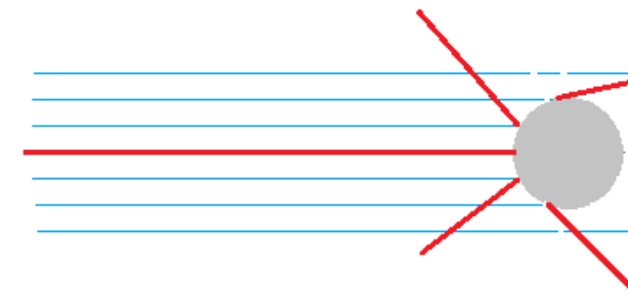
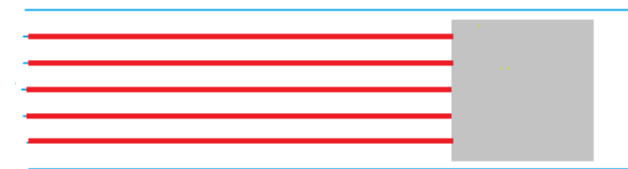
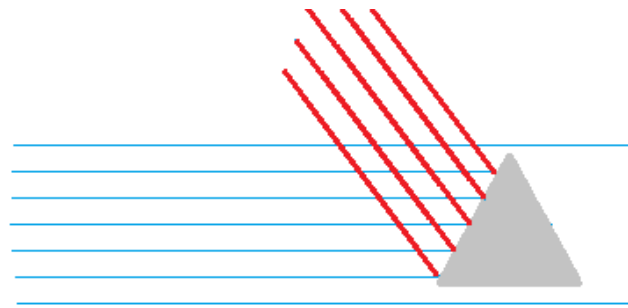
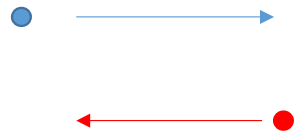
Seconda Università di Napoli and INFN – Napoli



Come
vediamo?



In alternativa

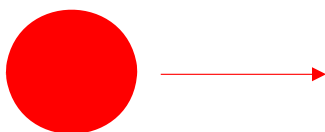
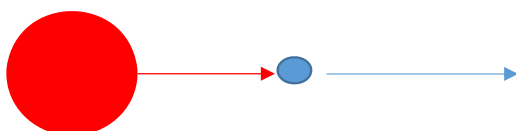
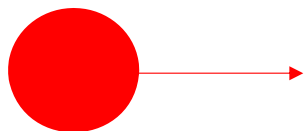
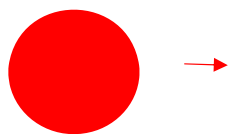


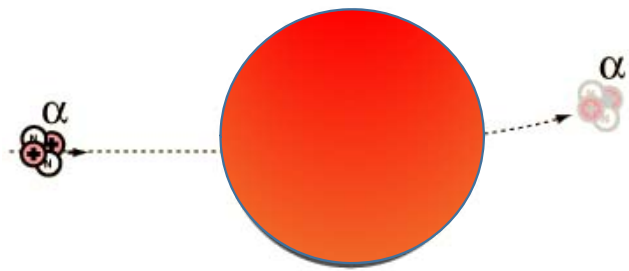
Sezione d'urto
di interazione

$$m_1 v_1 + m_2 v_2 = m_1 v_0$$

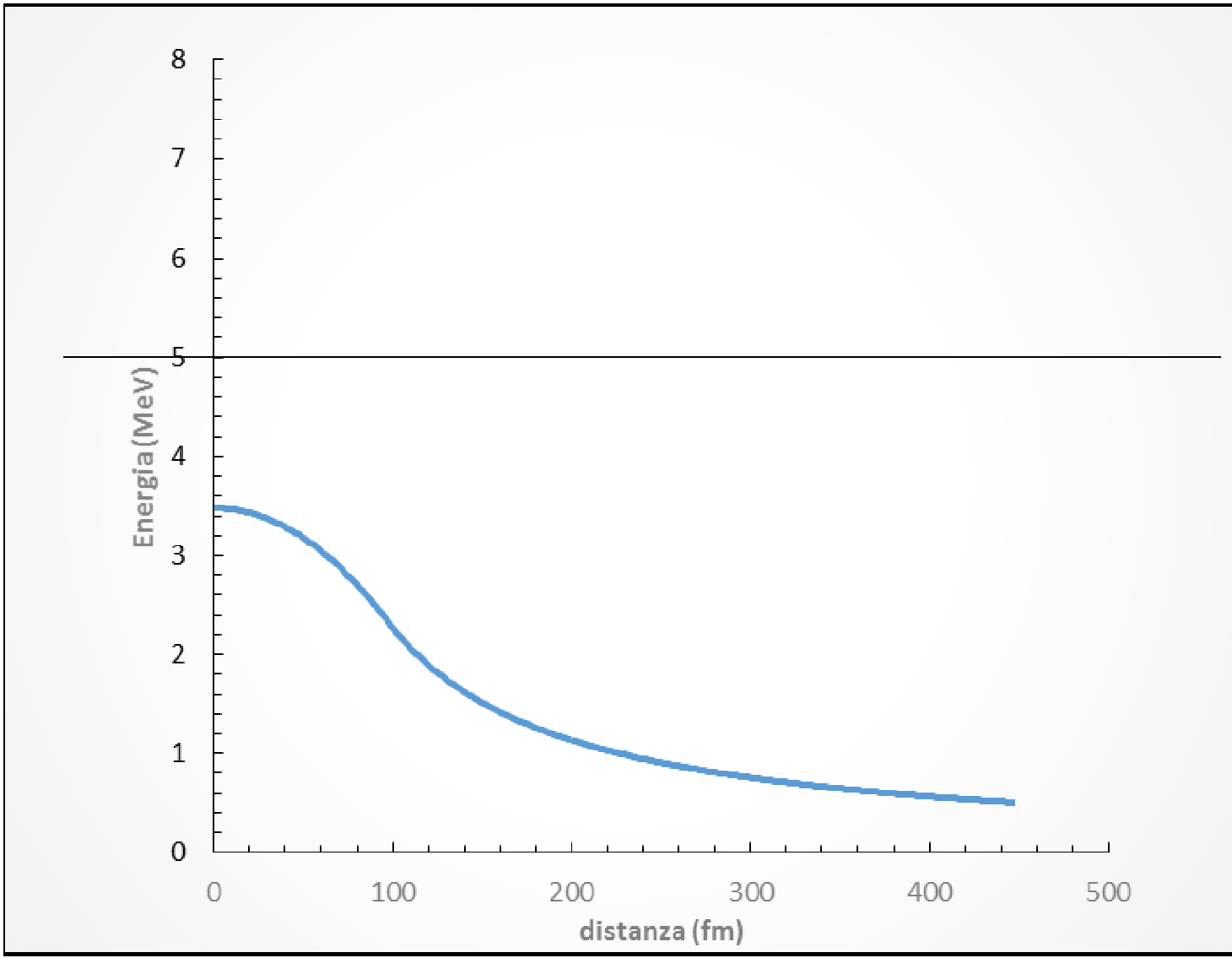
$$\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2} m_1 v_0^2$$

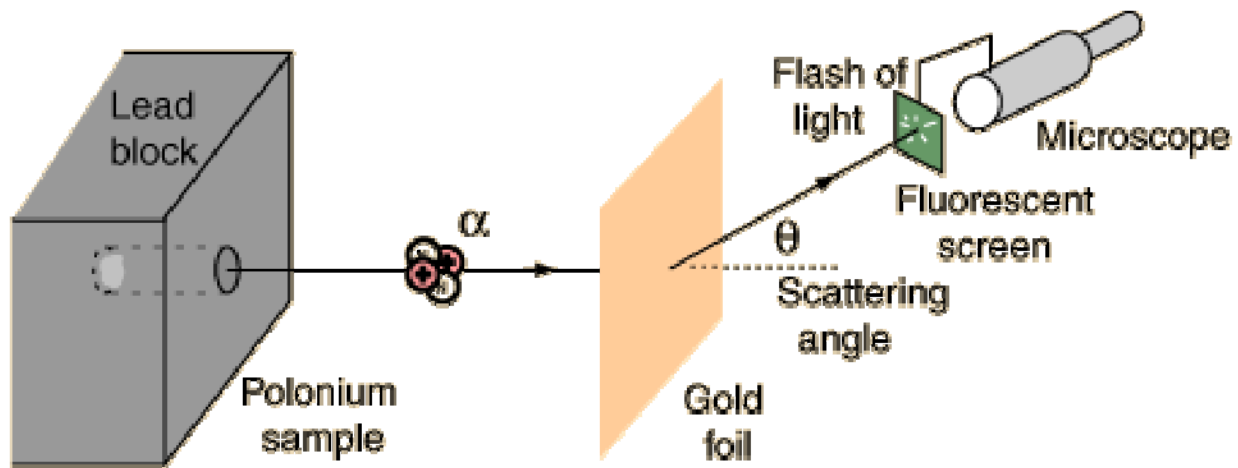
Urti elastici



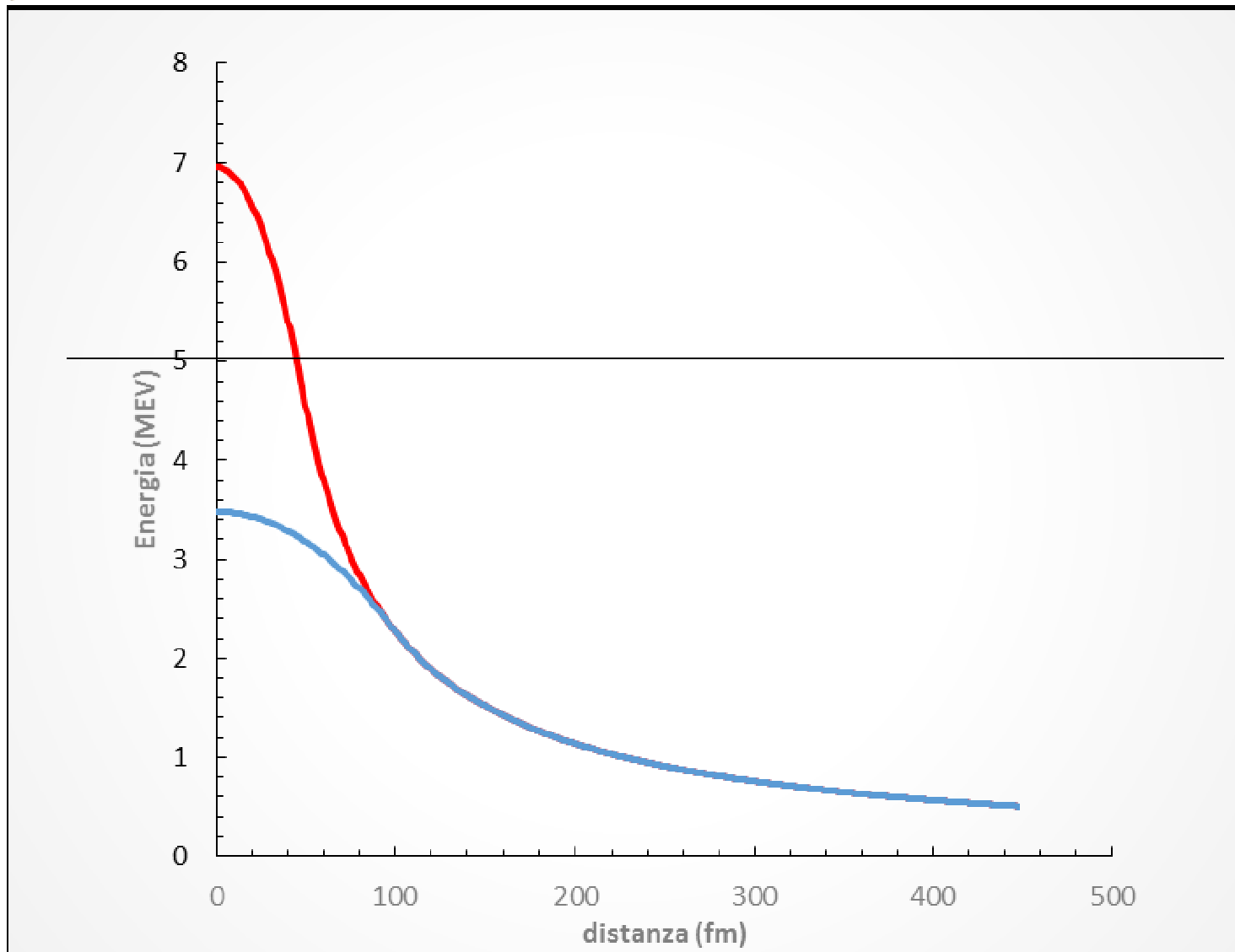
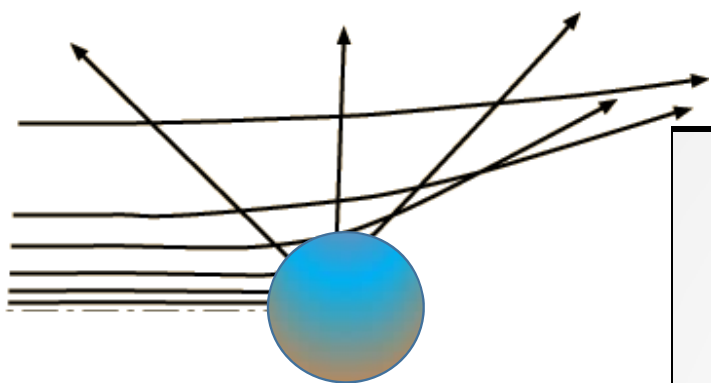


Modello atomico di Thomson





<http://hyperphysics.phy-astr.gsu.edu/hbase/rutsca.html>





rutherford-scattering_en.jnlp

<http://phet.colorado.edu/en/simulation/rutherford-scattering>

In Europa ci sono circa 250 milioni di auto

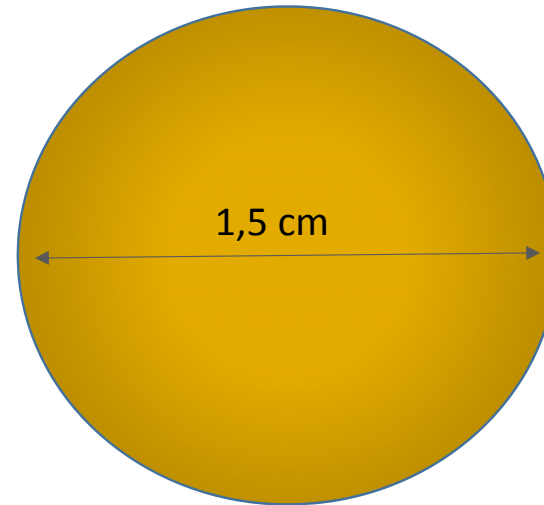


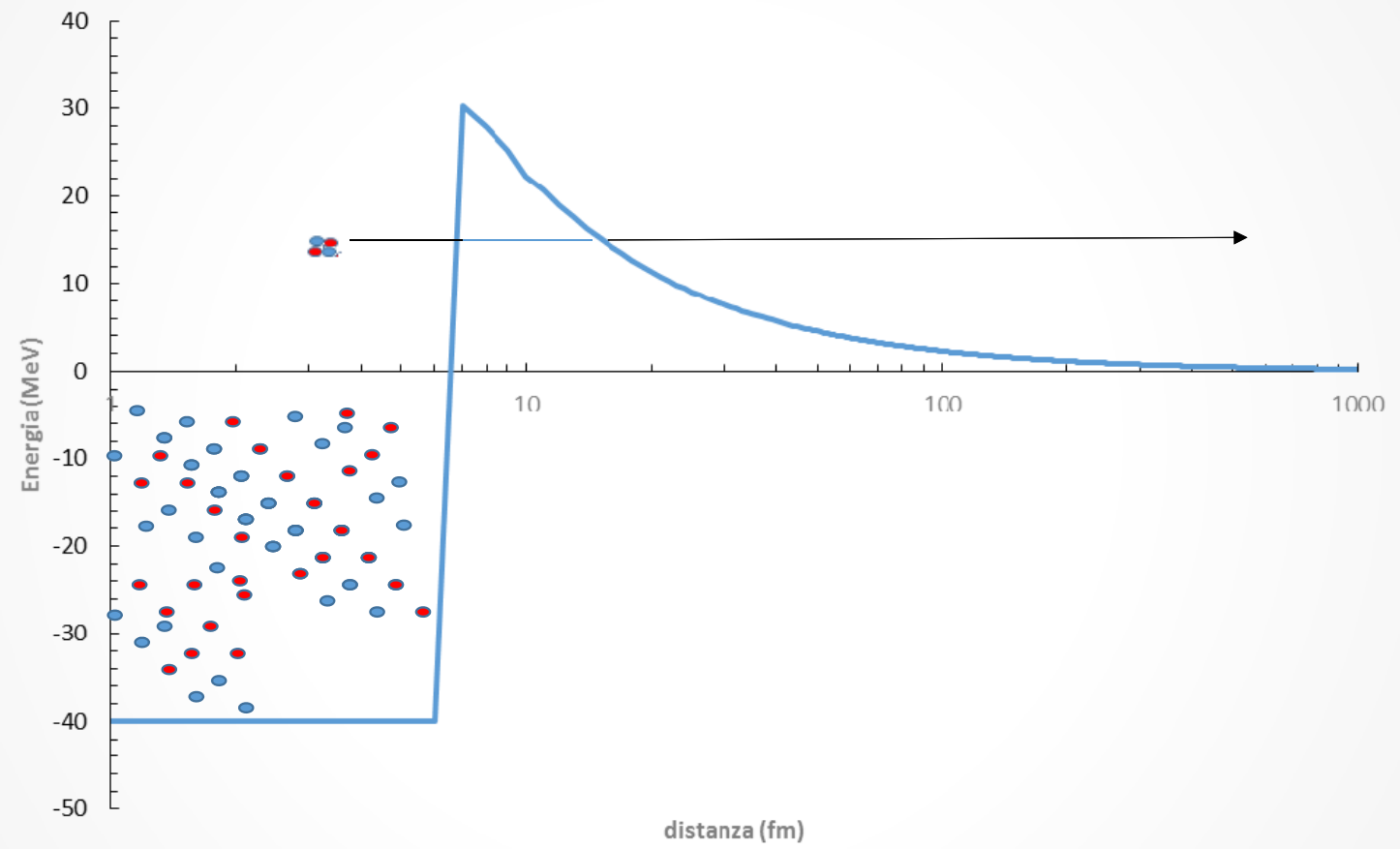
Modello atomico di Rutherford

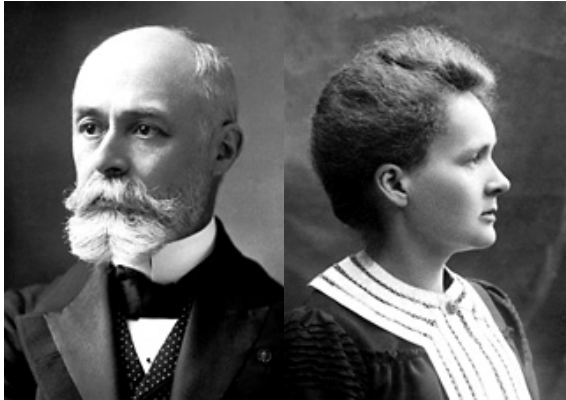
$$R_N \approx 1.22 A^{1/3} 10^{-15} m$$

$$M_N \approx A \cdot 2 \cdot 10^{-27} kg$$

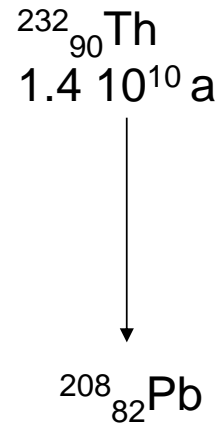
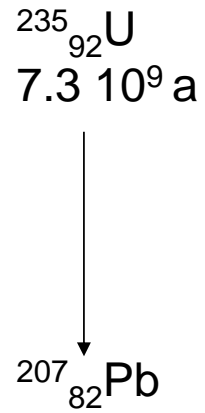
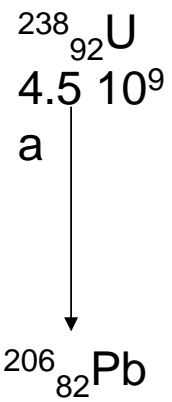
$$\rho_N = \frac{M_N}{\frac{4}{3}\pi R_N^3} \approx \frac{2 \cdot 10^{-27} kg}{8 \cdot 10^{-45} m^3} \approx 2.5 \cdot 10^{17} \frac{kg}{m^3}$$

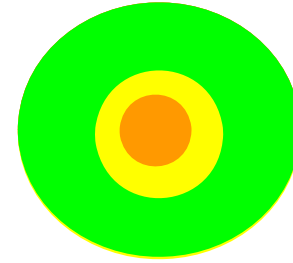
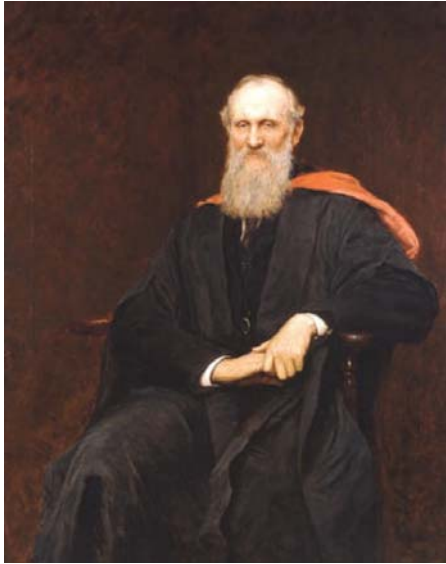




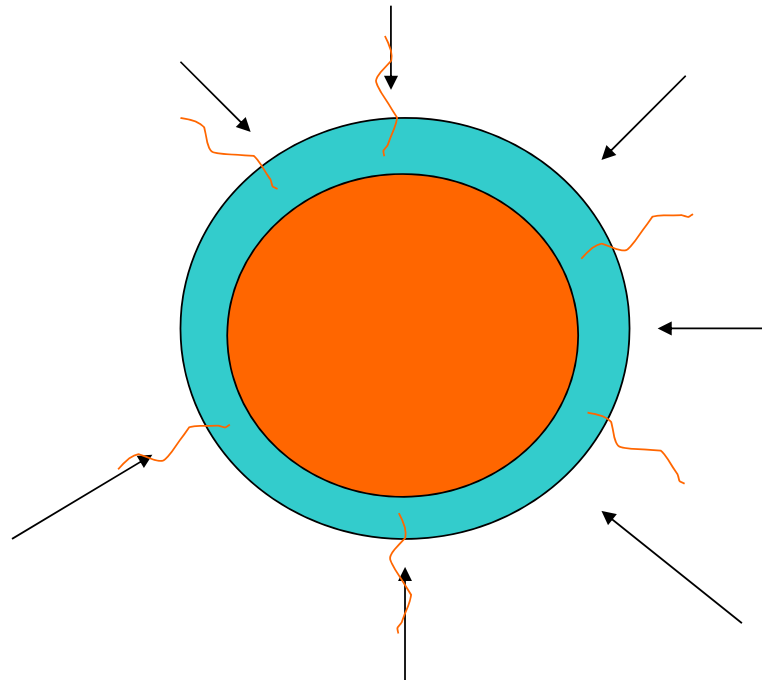


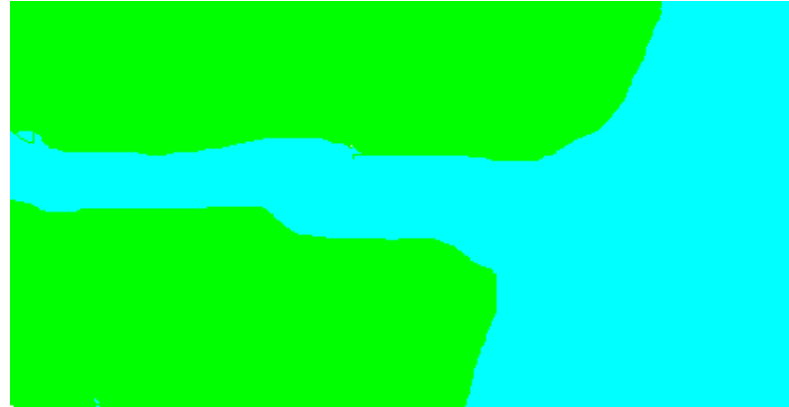
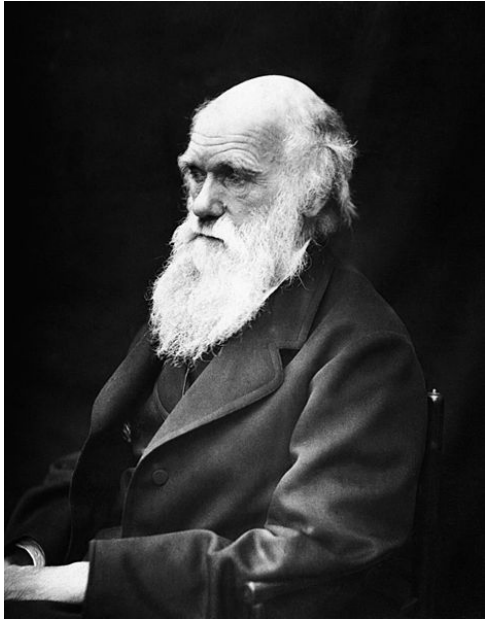
Serie radioattive



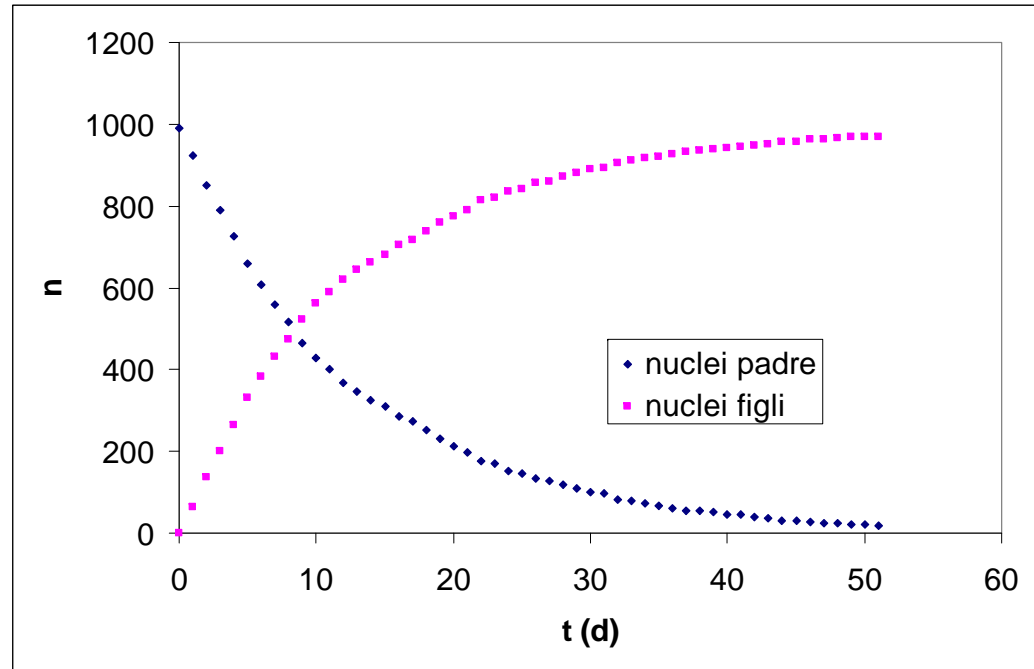


Circa 30 milioni di anni

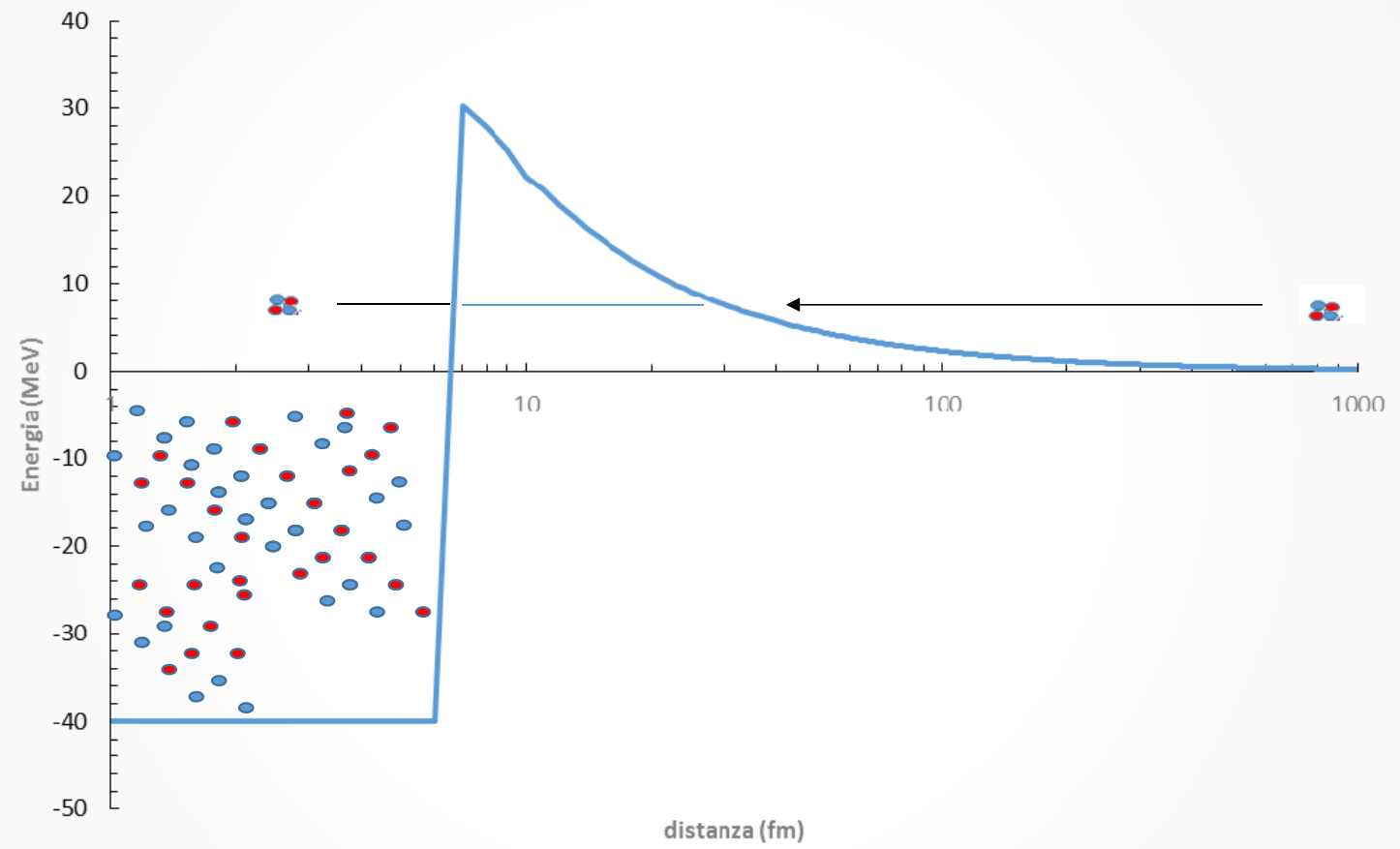


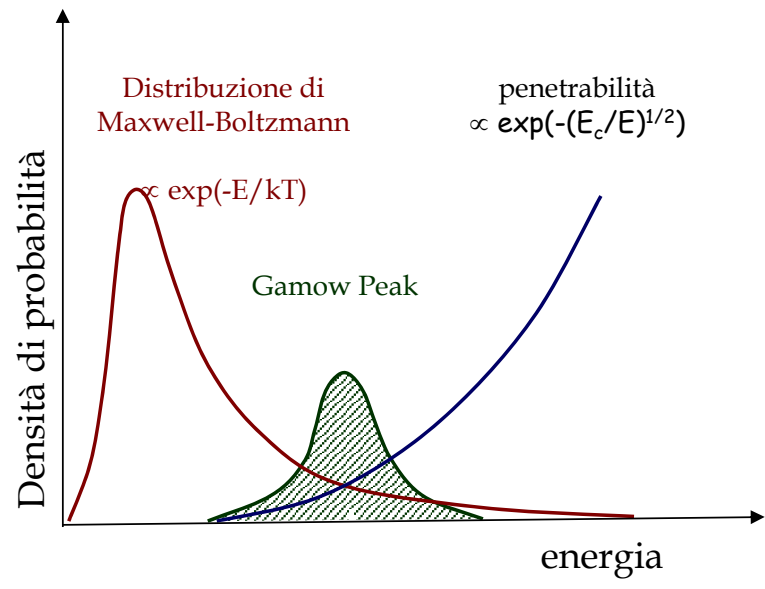


300-400 milioni di anni

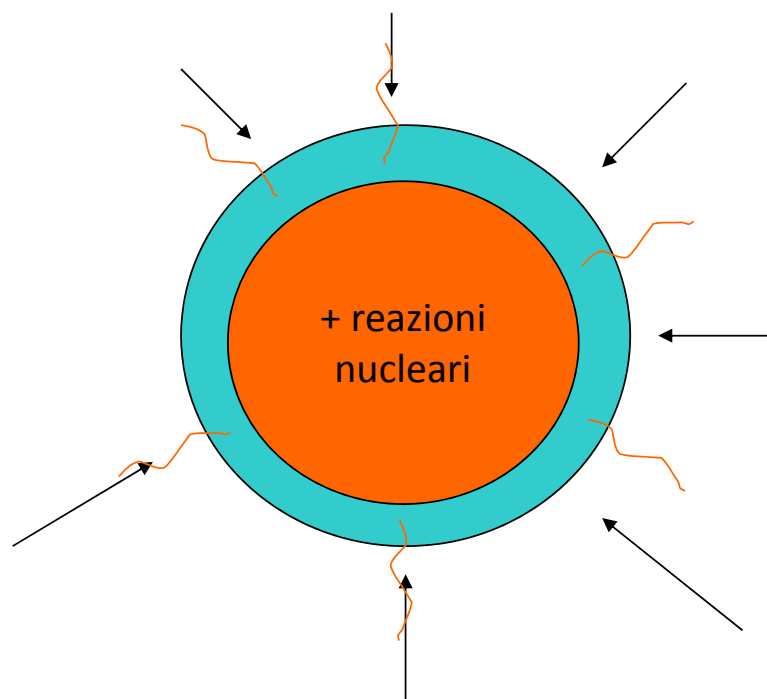


4.5 miliardi di anni





$$E_0 = f(Z_1, Z_2, T)$$



Ogni secondo 4
milioni di tonnellate di
materia solare
si trasformano in energia

11 miliardi di anni

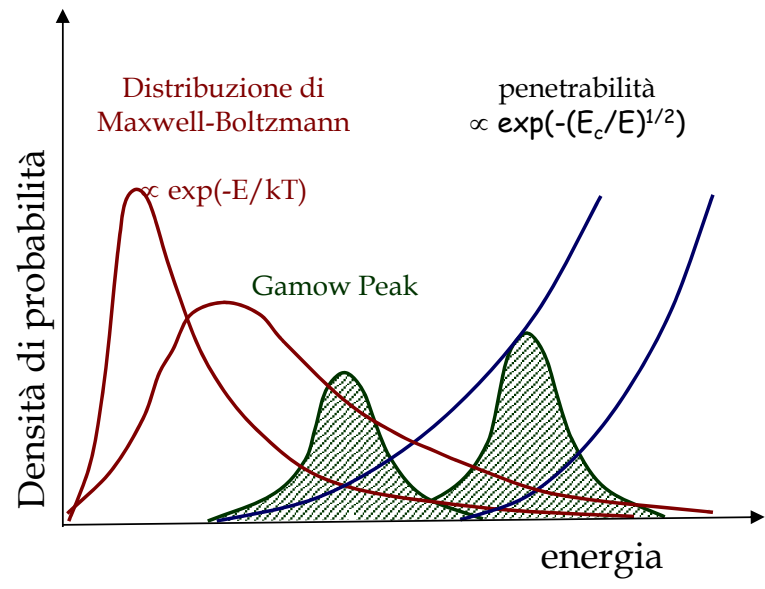
$$E_0 = 1.22 (Z_1^2 Z_2^2 \mu T_6^2)^{1/3} \text{ keV}$$

Sole : $T_6 = 15 \cdot 10^6 \text{ K}$
--

reaction	$E_0(\text{keV})$	Integral
p+p	5.9	$7 \cdot 10^{-6}$
$\alpha + {}^{12}\text{C}$	56	$5.9 \cdot 10^{-56}$
${}^{16}\text{O} + {}^{16}\text{O}$	237	$2.5 \cdot 10^{-237}$

→ Fasi separate

→ $10^{-21} \text{ barn} < \sigma < 10^{-9} \text{ barn}$



$$E_0 = f(Z_1, Z_2, T)$$

Nucleosintesi

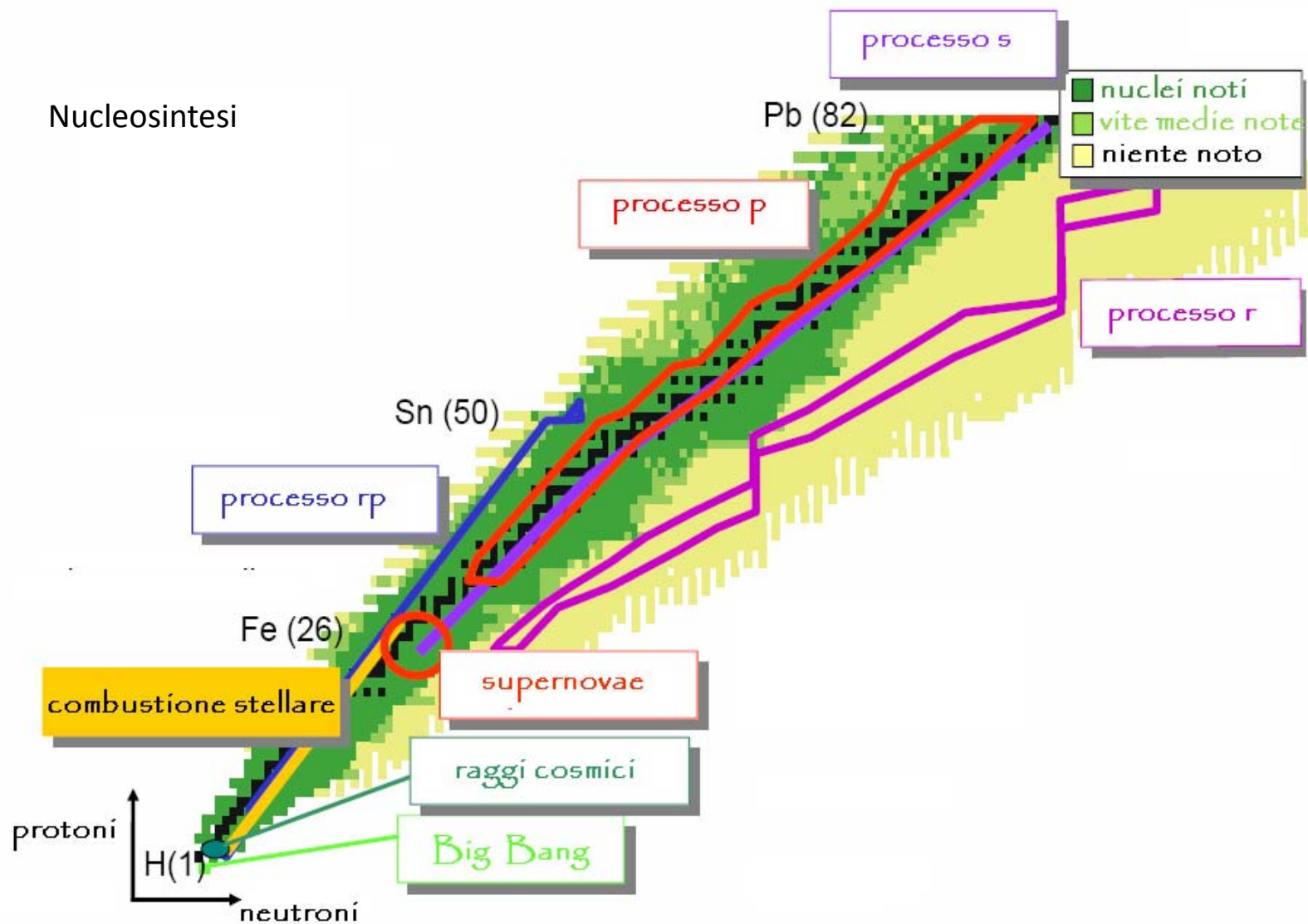
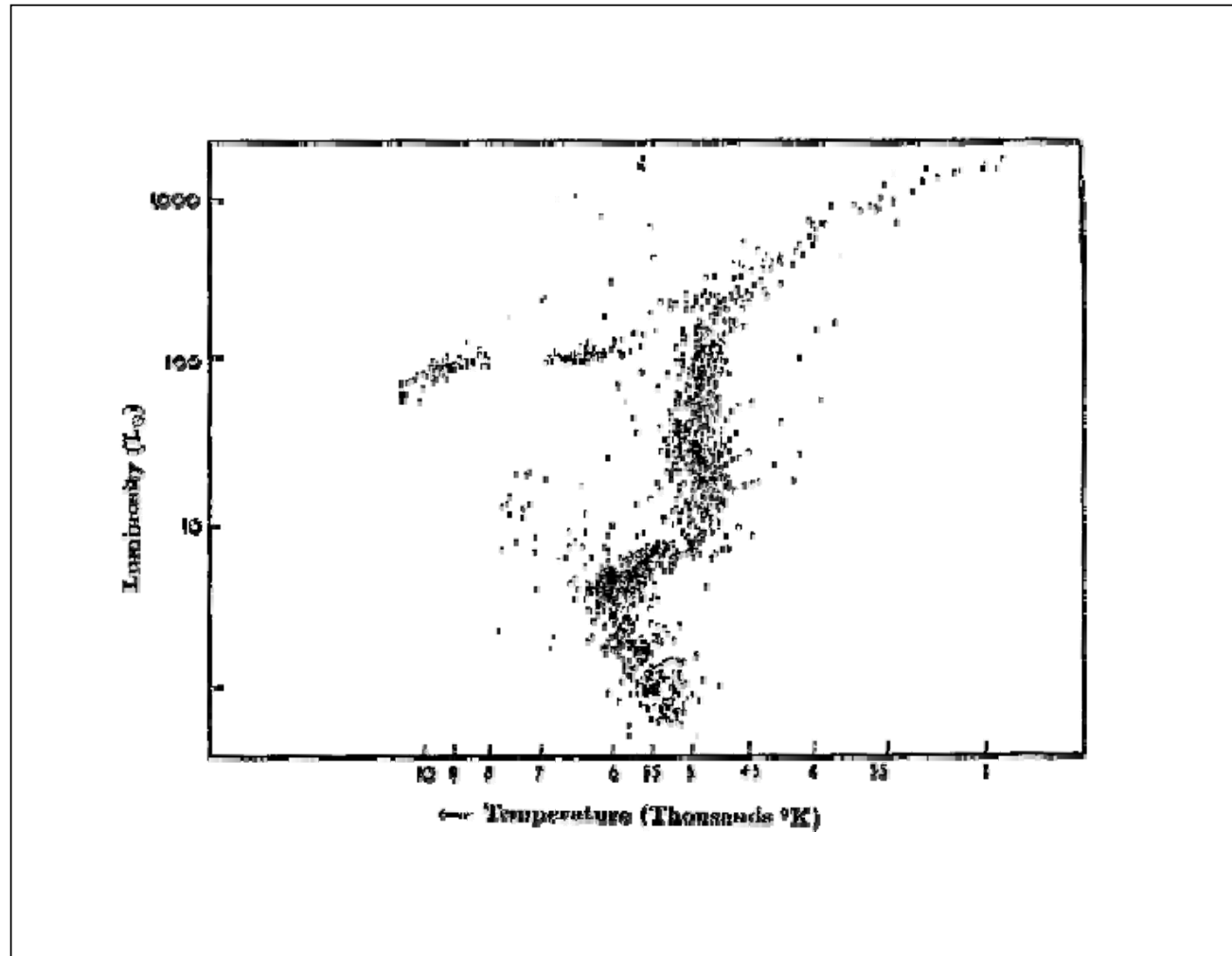


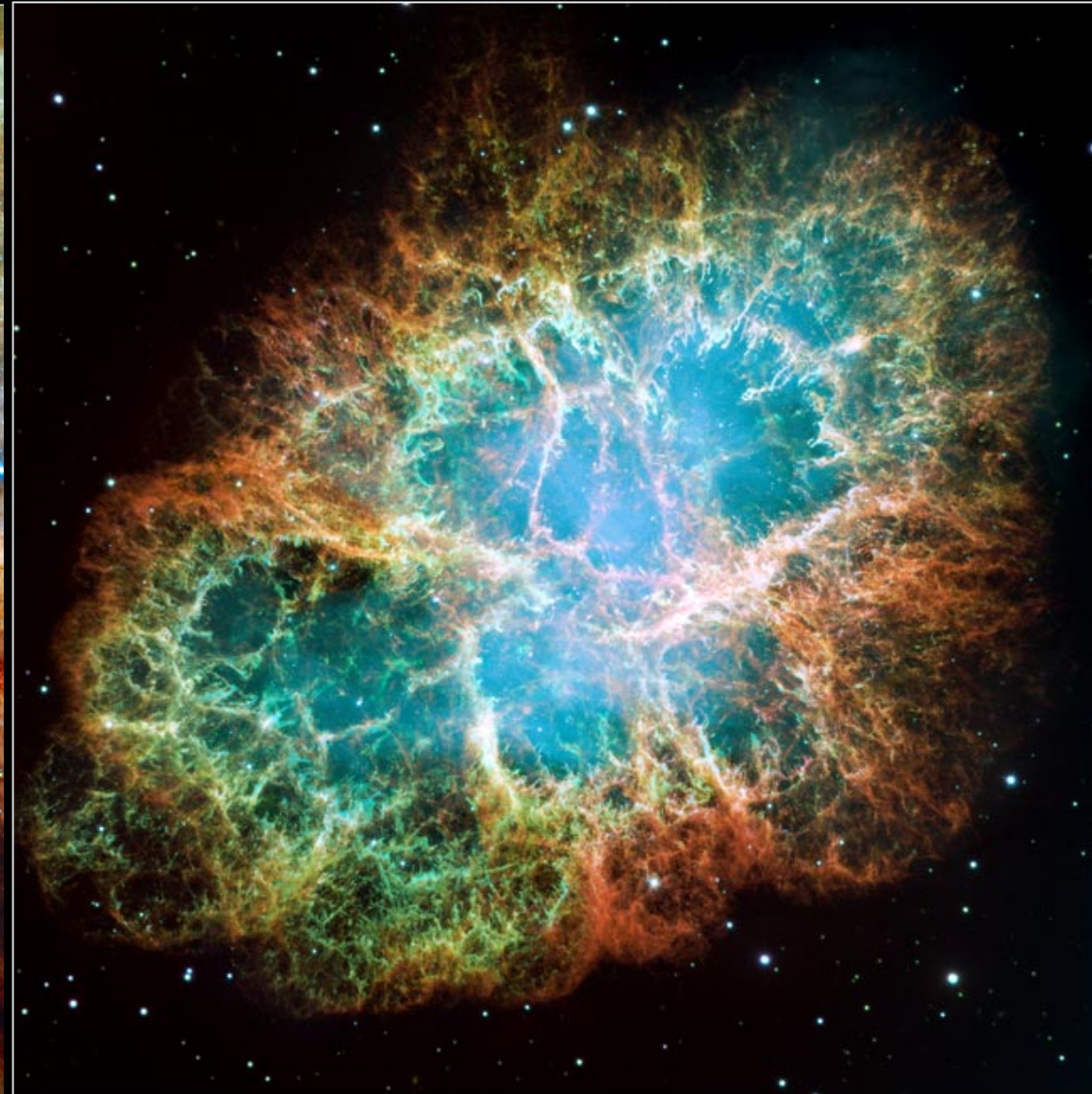
Diagramma HR per ammassi globulari



Star-Forming Region 30 Doradus

HST • WFC3/U Crab Nebula • M1

HST • WFPC2



NASA, ESA, F. Paresce (INAF-IASF, Italy), and the WFC3 Science Oversight Committee

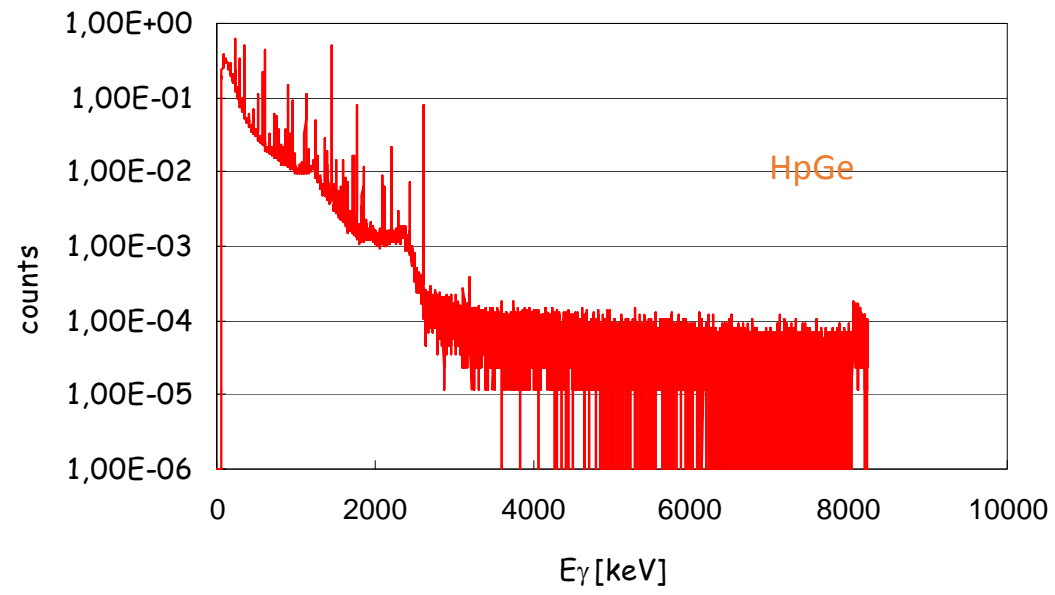
STScI-PRC00 NASA, ESA, and J. Hester (Arizona State University)

STScI-PRC05-31

Reazioni di fusione completa: $X(\alpha, \gamma)Y$

Nessun fondo naturale

Fondo dovuto a raggi cosmici e
Radioattività naturale

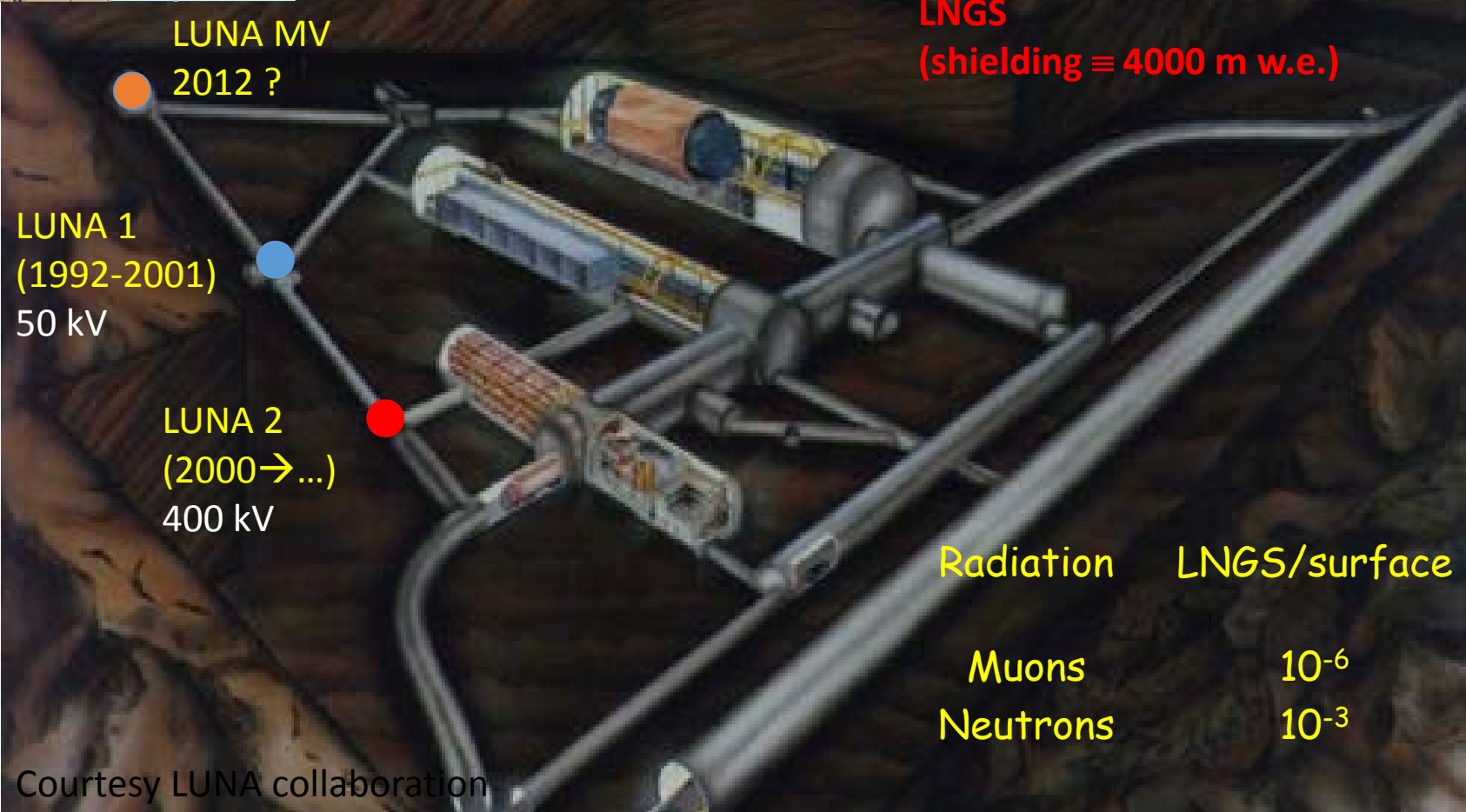


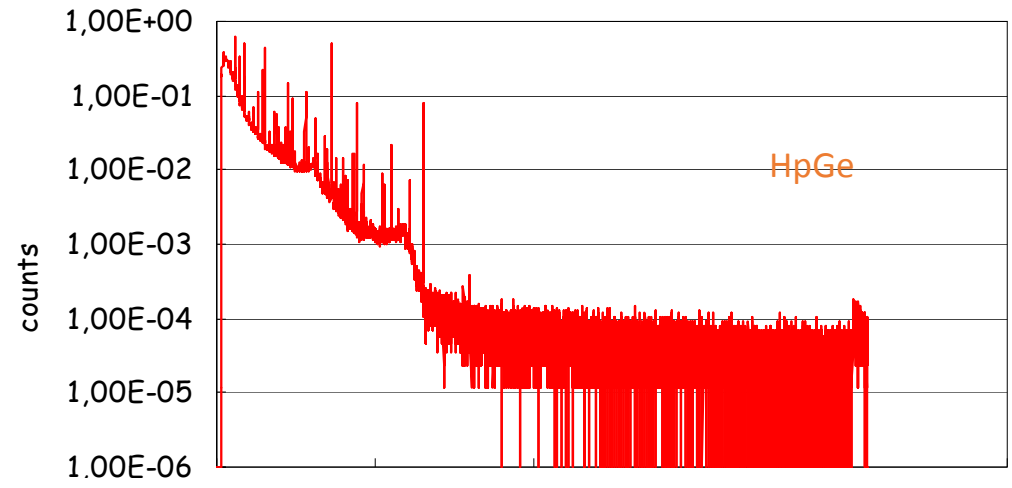
0.5 Counts/s

Laboratory for Underground Nuclear Astrophysics



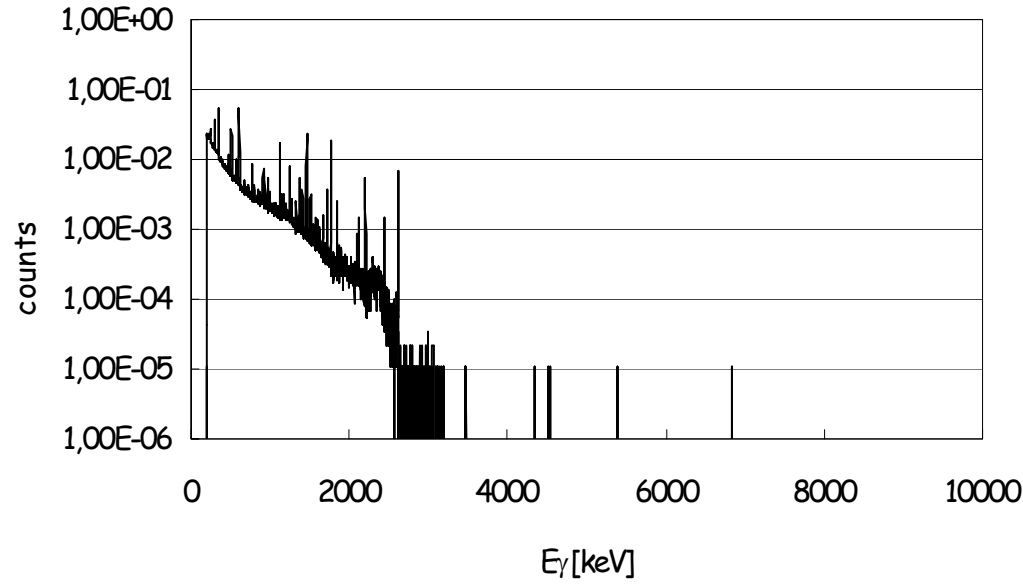
LUNA site





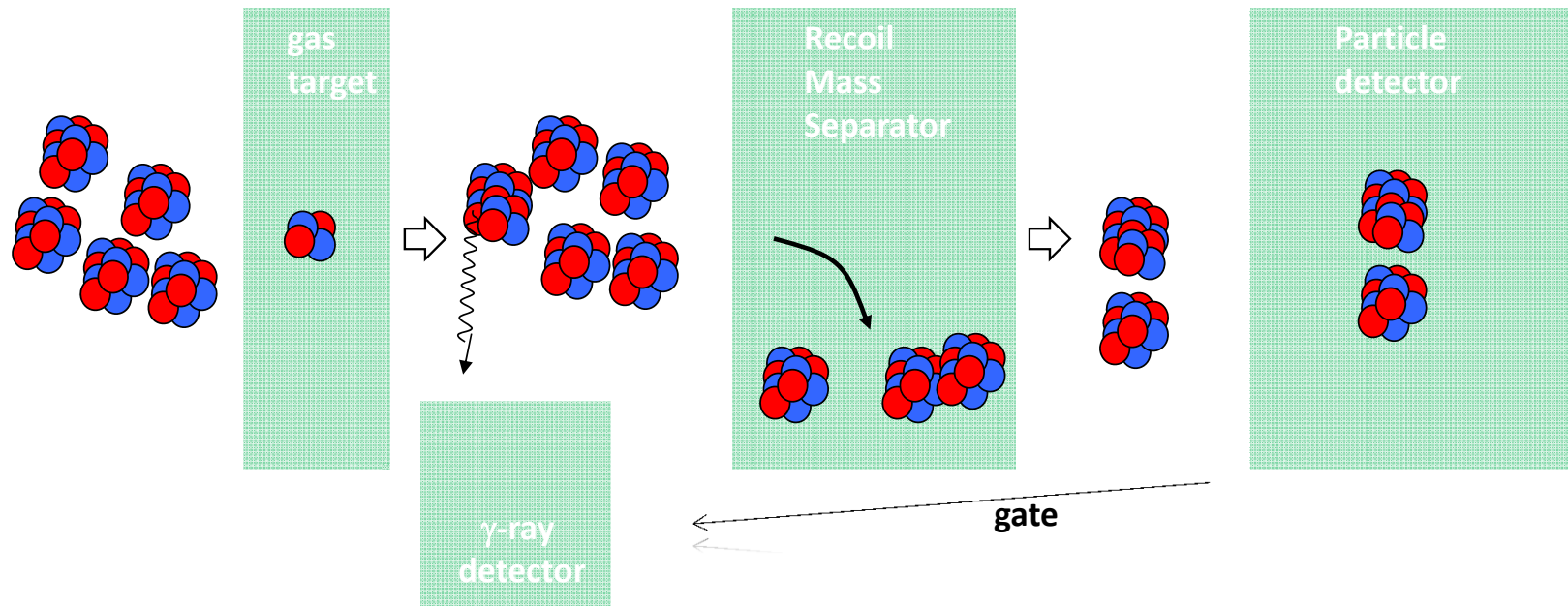
0.5 Counts/s

↓
GOING
UNDERGROUND



0.0002 Counts/s

RMS : working principle

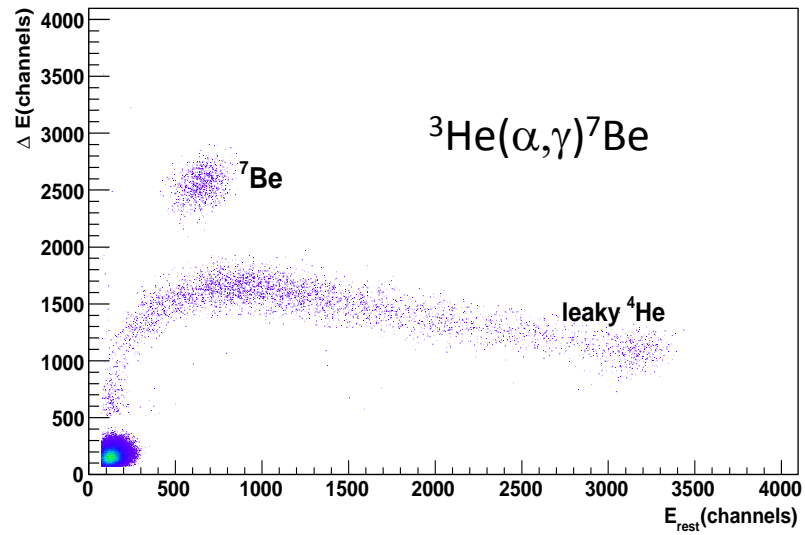
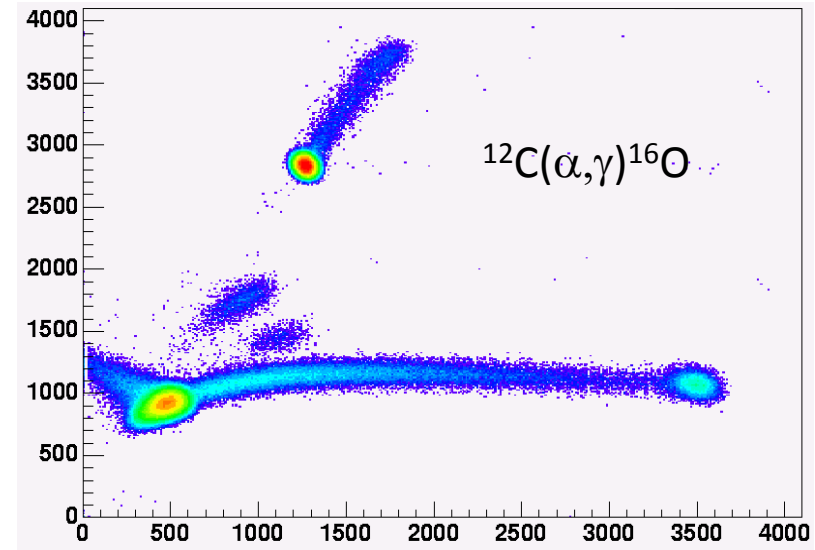


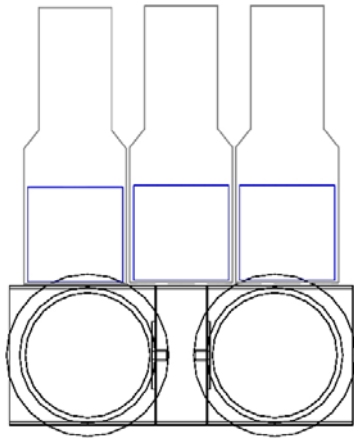
Recoil detection

Soppressione del fascio
incidente

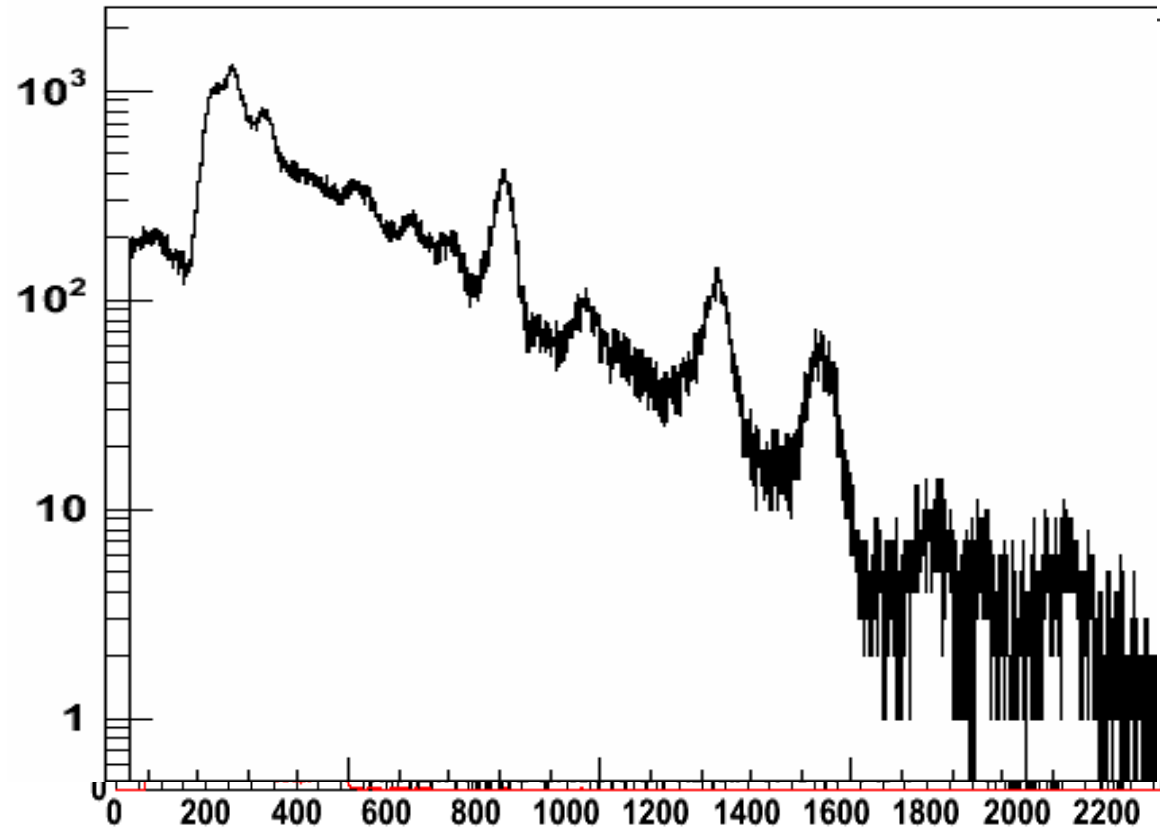
Separatore: 10^{-10} - 10^{-11}

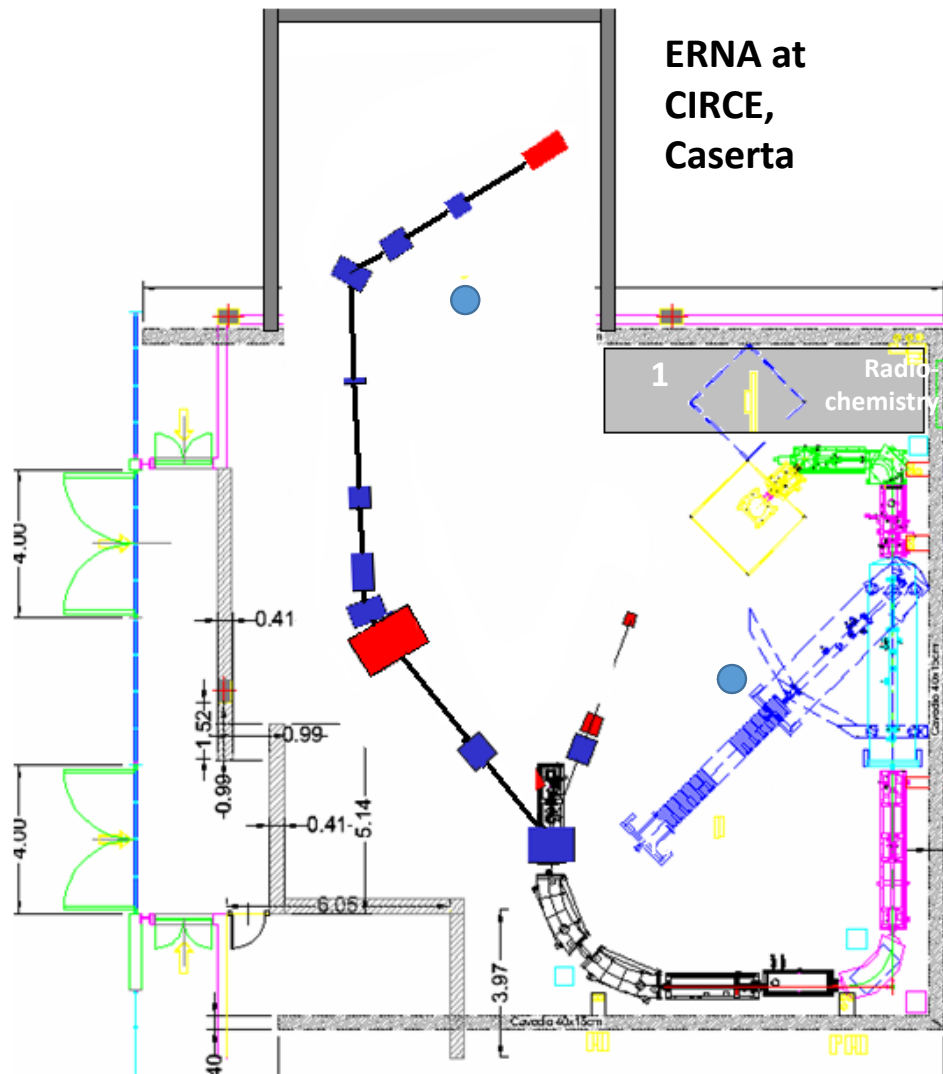
Rivelatore : 10^{-3} - 10^{-6}





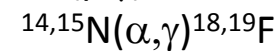
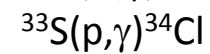
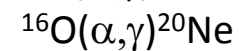
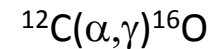
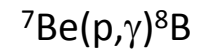
${}^3\text{He}(\alpha, \gamma){}^7\text{Be} - \gamma$ measurements





3MV Pelletron
 High intensity stable and
 radioactive (${}^7,{}^{10}\text{Be}$) ion beams
 (possible ${}^{26}\text{Al}$)

Plans:



SHE in nature

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