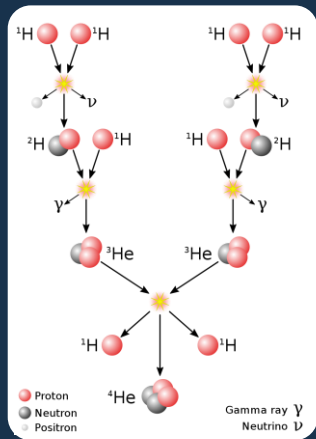


# Looking at the heart of the Sun

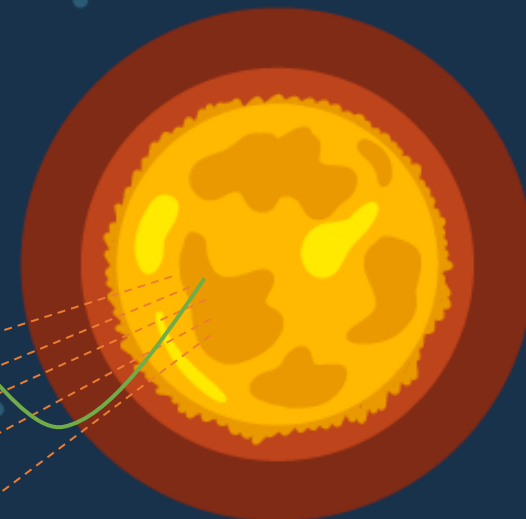
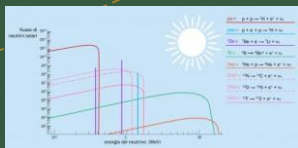
Neutrinos are light, weakly-interacting particles produced by fusion reactions inside the core of the Sun. Their existence was suggested by the Austrian physicist Wolfgang Pauli in 1930.

The Sun burns by transforming hydrogen into helium in the so called pp chain. For each  $^4\text{He}$  produced two neutrinos are emitted. About  $10^{37}$  neutrinos leave the Sun each second.



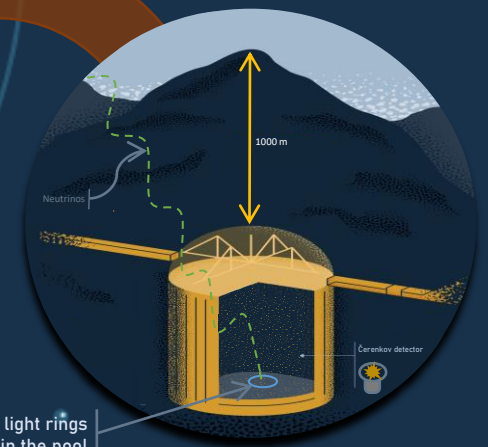
The pp-chain

4) In the Gran Sasso National Laboratories, the Borexino experiment is capable of separately measuring the neutrino fluxes of the various nuclear reactions that occur in the sun



1) When we look to the Sun we see light produced about 100.000 years ago, since the photons composing the light scatter back and forth inside the hot plasma of our star. On the contrary, neutrinos interact so weakly that they leave the Sun undisturbed in about 2 seconds.

2) There are three type of neutrinos: electronic, muonic and tauonic. Only electronic neutrinos are produced in the Sun. However, while travelling to the Earth, electronic neutrinos transform like chameleon into muonic and tauonic neutrinos. This phenomenon is called "neutrino oscillation" predicted for the first time by the Italian physicist Bruno Pontecorvo in 1957.



3) Physicists observe neutrinos arriving from the Sun with special detectors. Super Kamiokande, in Japan, is one of these, a pool of 50,000 tons of pure water surrounded by light-sensitive devices called photomultipliers. Electronic neutrinos crossing this pool leave their signature as light rings (Čerenkov radiation).

By detecting neutrinos, just after 8 minutes from their production, we monitor the fusion processes inside the core of the Sun ...  
**we literally look at the heart of the Sun.**