The how and the why of laser ionized radioactive beams at CERN ISOLDE

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What do we do and how do we do it?

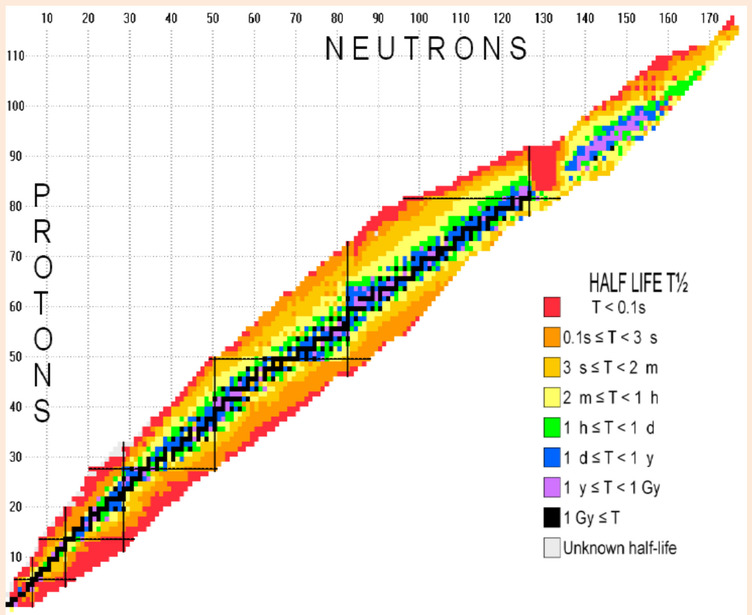
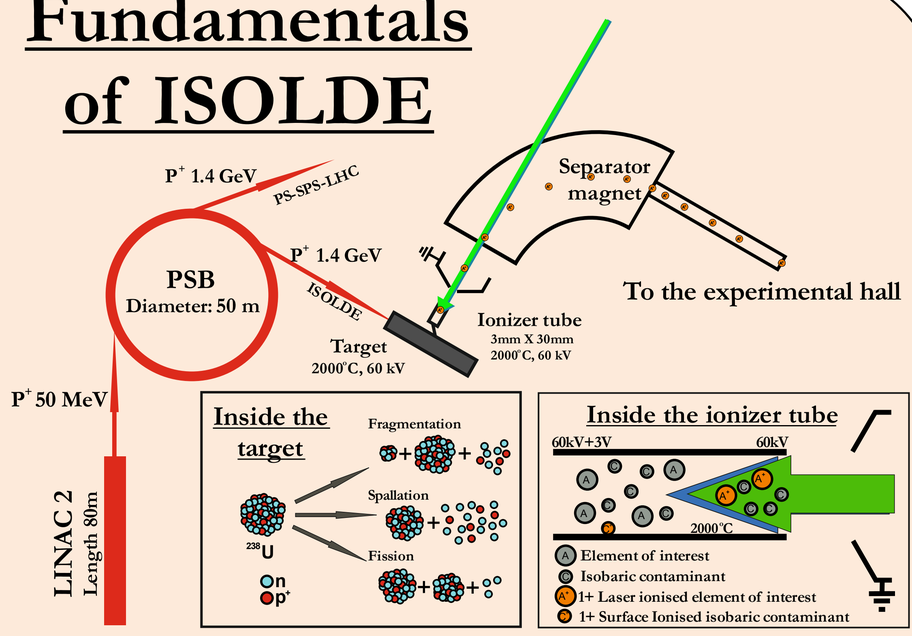


Chart of the nuclides colour coded for half life.
Audi, G. et al. 2003 http://dx.doi.org/10.1016/j.nuclphysa.2003.11.001

In order to investigate their properties, short lived isotopes must be created. At ISOLDE we produce accelerated beams of short lived "exotic" isotopes. The RILIS (Resonance Ionization Laser Ion Source) is the principle ion source of the ISOLDE Facility (1).

Fundamentals of ISOLDE

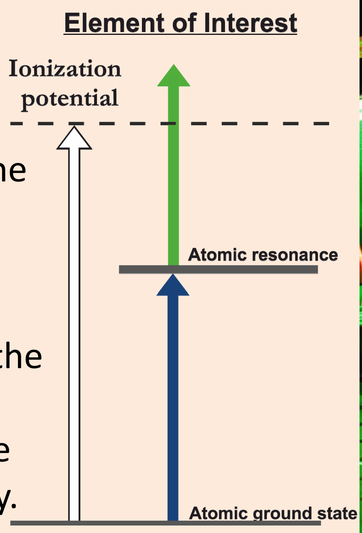


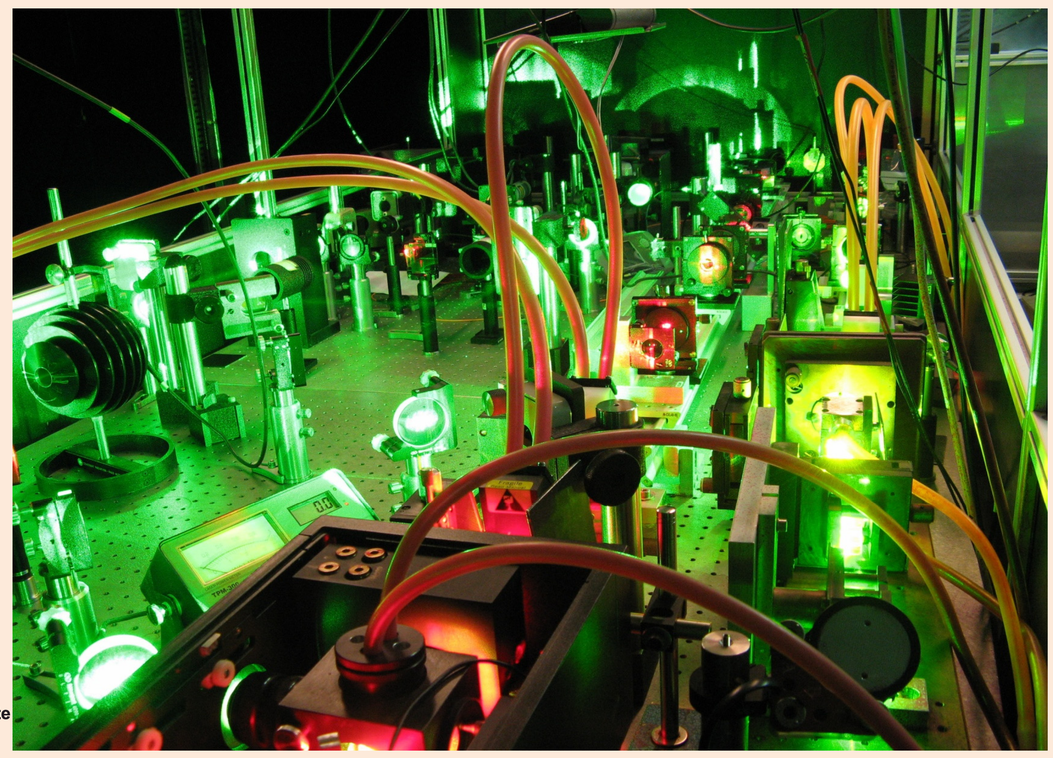
Protons at 1.4 GeV are extracted from the PSB to impact upon an ISOLDE target. The reaction products are ionized, and extracted as a radioactive beam, this is filtered by a mass separating magnet for purification before being directed to experiments or reacceleration in the ISOLDE Hall.

Fundamentals of a laser ion source

The distribution of atomic energy levels is element unique.

Transitions between energy levels can be induced when the atom is illuminated by photons with an energy (light of the correct colour) that matches the transition energy.





We use lasers because they can produce directed beams of "monochromatic" light

The Sun Vs RILIS

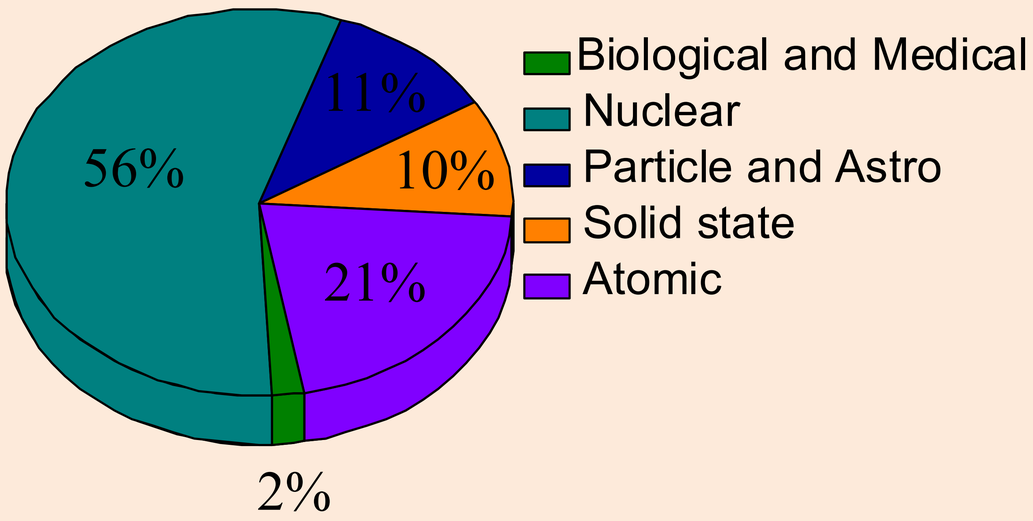
The spectral brightness of RILIS is

30,000,000 times

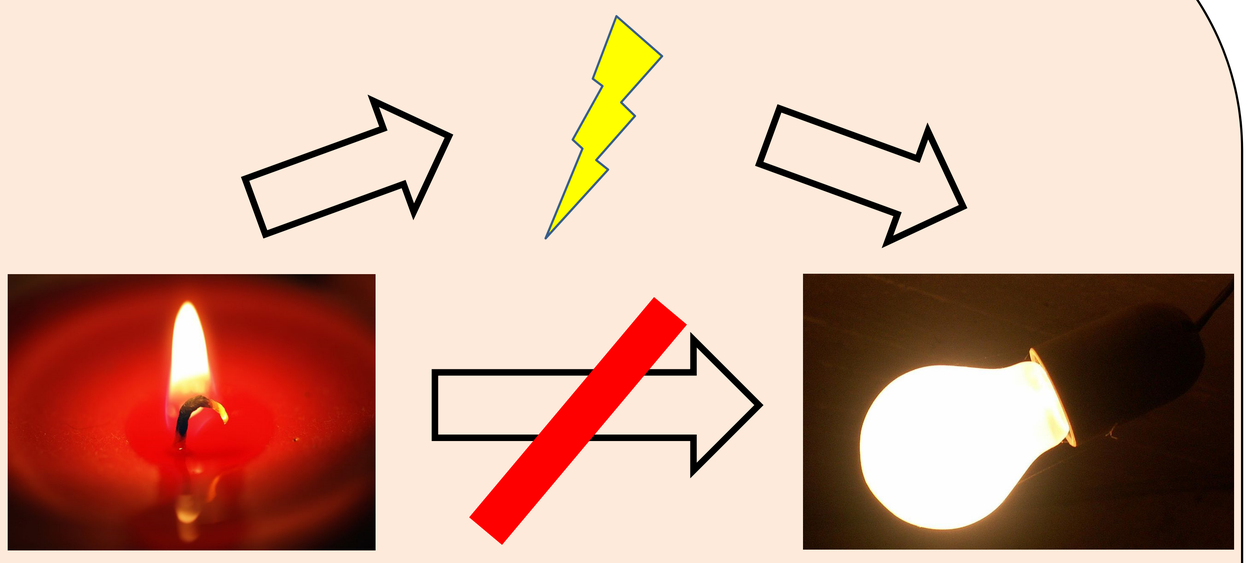
greater than The Sun's at sea level!

Applications

Physics at ISOLDE



Why bother with fundamental physics?



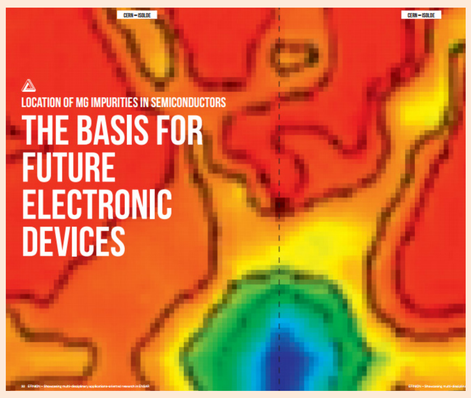
It took the investigation and harnessing of electricity to move us from the candle to the lightbulb

Medical isotopes

Terbium, a possible **"Swiss Army Knife of Nuclear medicine"**

Our range of isotopes for medicine is currently limited by production mechanisms (2).

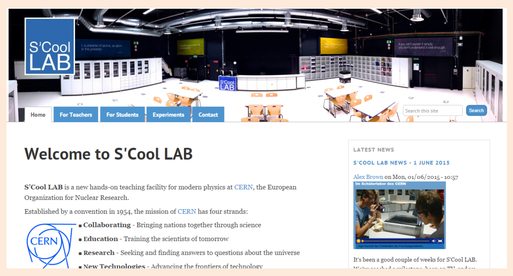
Next generation semiconductors

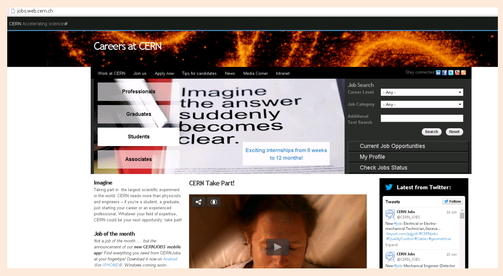


A better understanding of the distribution of Mg in GaN semiconductors could lead to considerable reductions in the energy consumption of electronic devices (2).

Visit us or work with us!

Opportunities include the S'Cool Lab, the summer student programme and CERN visits





http://scool.web.cern.ch/
http://outreach.web.cern.ch/outreach/visites/index.html
http://jobs.web.cern.ch/programme/summer-student-programme/summer-students

References

1) Fedosseev, V. N. et al. (2012). Upgrade of the RILIS at ISOLDE; Rev. Sci. Inst 83(2), 02A903. doi:10.1063/1.3662206.
2) EFINION project summary http://www.ensarfp7.eu/projects/efinion

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This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 289191