Coulomb Dissociation of $^{27}$P: an alternative way to study the $^{26}$Si(p,$\gamma$)$^{27}$P reaction

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The reaction $^{26}$Si(p,$\gamma$)$^{27}$P is relevant to the synthesis of $^{26}$Al. $^{26}$Al β decays to an isomeric state of $^{26}$Al which then decays into the ground state of $^{26}$Mg (no γ-ray emitted).

The 1.809 MeV γ line is only emitted by the β decay of $^{26}$Al to the ground state.

At high temperatures there is equilibrium between the isomeric state (0\textsuperscript{+}) and the ground state (5\textsuperscript{+}). The process $^{26}$Si(p,$\gamma$)$^{27}$P gives information about the production of the isomeric state, that means information of the ground state in the equilibrium.

### Astrophysical interest

- ESA's Integral observatory has detected the presence of radioactive $^{26}$Al in the interstellar medium (central regions of the Milky Way) by measuring the 1.809 MeV γ rays coming from the decay of $^{26}$Al.

- These observations confirm that the production of new heavy nuclei is an ongoing process.
- The amount of $^{26}$Al (rare isotope) produced is surprisingly high.
- It is clear that the nuclear physics of isotopes around $^{26}$Al such as $^{27}$P or $^{28}$Si is very interesting.

### Motivation

- An ion A bombards a high-Z target
- A is Coulomb excited to A\* decaying into B+c
  - *In the reaction A(γ)cB a virtual photon produced by the Coulomb field of the target is absorbed.*

- The C.D. Method \cite{1,2} is mostly suited when the target is not stable so direct reactions cannot be studied easily and also when the binding energy is small to ensure dominant Coulomb character of the reaction.
- The use of relativistic energies allows to work with thicker targets.

### Our experiment

- We performed a $^{27}$P C.D. experiment at GSI, Darmstadt (28 May-5 June 2007) using the ALADIN-LAND setup which allows complete-kinematical studies. The incoming beam and fragments were identified using energy-loss and time-of-flight measurements and the trajectories measured by different tracking detectors. A scheme of the setup can be seen in the pictures below.
- $^{36}$Ar at 680 AMeV was used as primary beam; a thicker reaction target with respect to the RIKEN experiment was used.
- We expect to get higher statistics than in the previous experiment in RIKEN being able to resolve the second and third resonances seen there with moderate resolution. The direct capture contribution will be much larger.
- The analysis of the obtained data has just started. We are presently performing the calibrations.

### References: