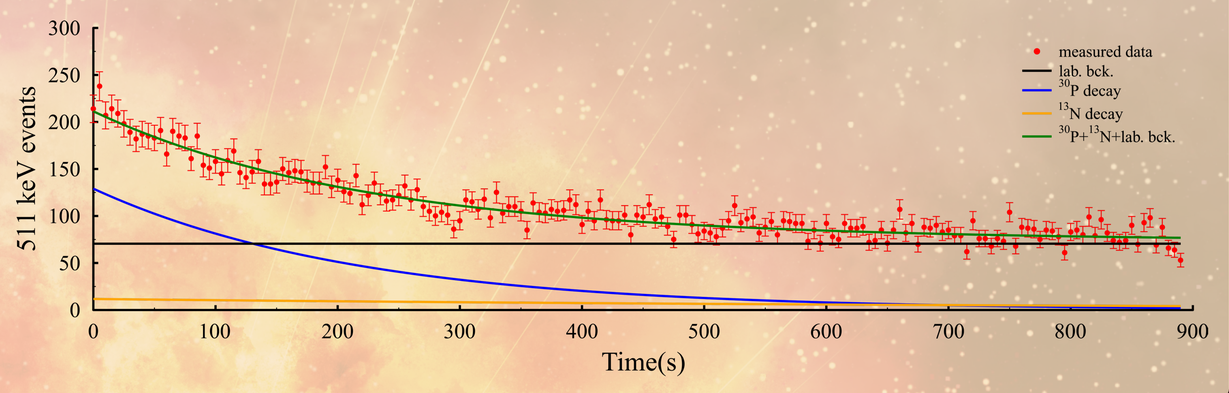
Measurement of the $E_p = 416.9$ keV resonance strength in the $^{29}Si(p,\gamma)^{30}P$ reaction

Zs. Mátyus[1,2] and Gy. Gyürky[1]

[1]HUN-REN Institute for Nuclear Research (Atomki), Debrecen, Hungary
[2]Doctoral School of Physics, University of Debrecen, Debrecen, Hungary

Aim of the work

Measure highly **uncertain resonance strength and unknown direct capture** in $^{29}Si(p,\gamma)^{30}P$



The detected 511 keV gammas and the components of the fit.

Introduction

The origin of ^{29}Si is unclear, could be produced by classical nova events, during a Thermonuclear runaway.

To prove this nova paternity, the reaction rates of its producing and destroying reactions must be known at the relevant temperatures.

The available data in the literature is ambiguous. Therefore, the aim of this work is to measure the E_p=416.9 keV resonance strength and the direct capture (DC) cross section.

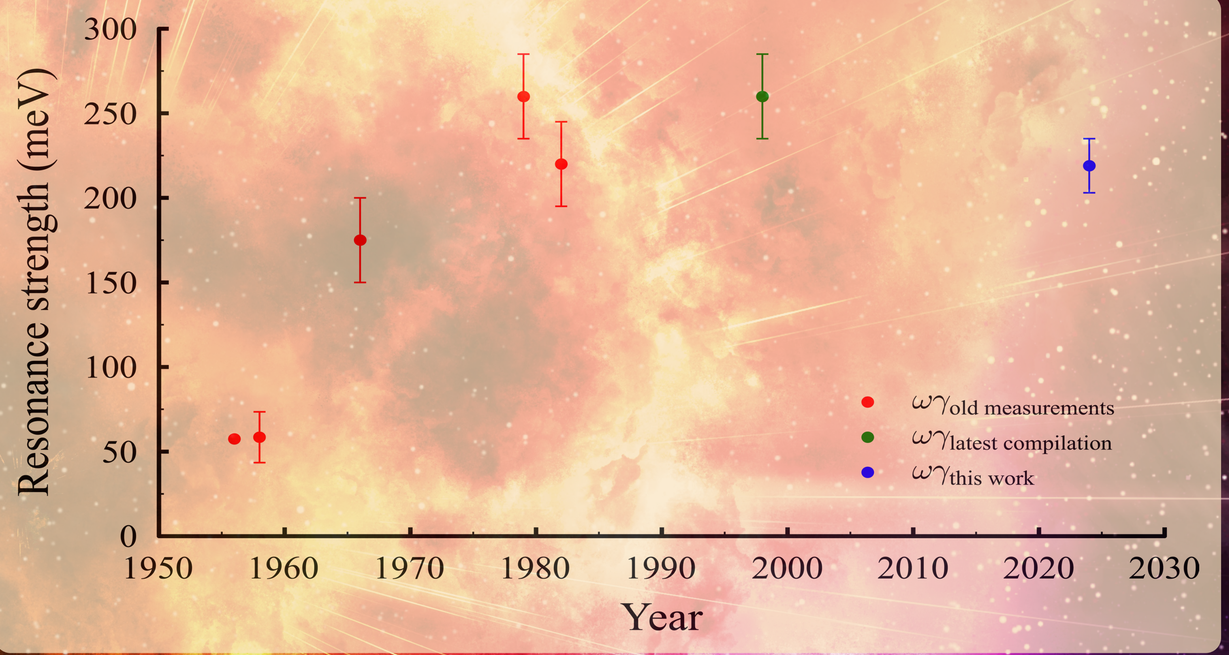
Results

After fitting the decay curve the Y yield of the reaction can be calculated.

The difference of the Y_{on_res} and Y_{off_res} gives the Y_{res} which is the yield of the studied resonance

The yield is connected to the ωγ resonance strength.

The new value of the resonance strength is ωγ=219.6 ±16 meV



The available data for the resonance strength. Our value is labeled with blue color

Method

The targets were SiO_2 sheets covered with thin Al layer.

The product of the reaction is radioactive. Therefore the activation technique can be used. The proton beam was provided by the Tandetron accelerator of Atomki.

As ^{30}P has a relatively short half-life, the target was not removed from the target chamber and the cyclic activation technique was used.

A 5 min of irradiation was followed by a 15 min decay period. A HPGe detector counted the 511keV annihilation radiation following the ^{30}P positron decay.

For statistical reasons this cycle was repeated up to 50 times.

Discussion and outlook

The new, more precise value of the resonance strength helps to reduce the $^{29}Si(p,\gamma)^{30}P$ reaction rate uncertainty.

There is no data in the literature for the DC component of the $^{29}Si(p,\gamma)^{30}P$ cross section. Therefore we plan to measure it with similar technique.

For this measurements enriched ^{29}Si targets are used. The targets were characterized with NRRA.

Preliminary DC cross section results from these measurements are available in the 1-1.5MeV energy range.

The experiments are still in progress.