Direct and Indirect measurements of $^{22}Ne(\alpha,\gamma)^{26}Mg$ in EASγ

EXPERIMENTAL STUDY OF $^{22}Ne(\alpha,\gamma)^{26}Mg$ NEAR-THRESHOLD STATES AT LOW ENERGY AND ITS CROSS SECTION FOR NUCLEAR ASTROPHYSICS

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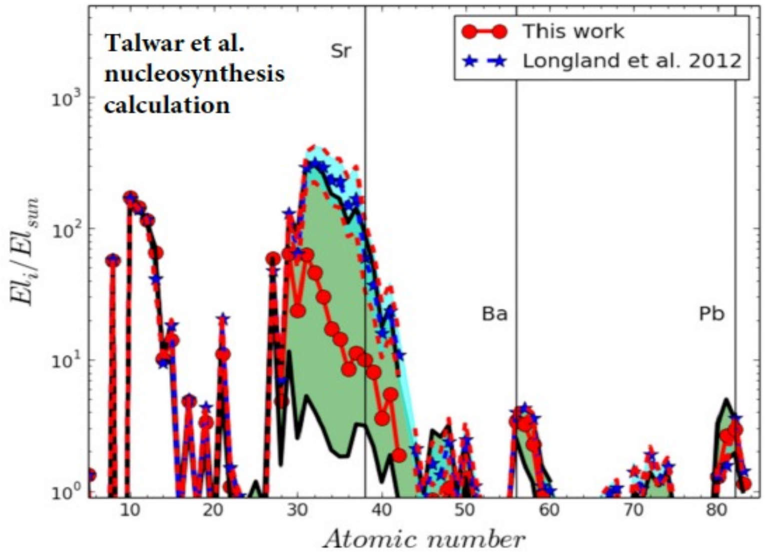
$^{22}Ne(\alpha,\gamma)^{26}Mg$ - Astrophysical motivation

He-burning of ^{22}Ne

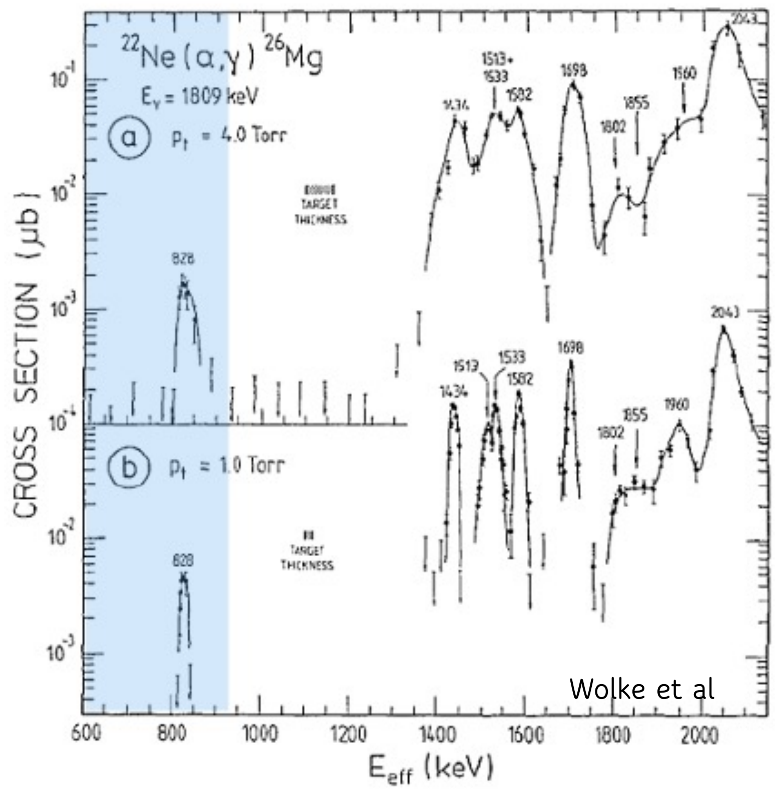
$^{22}Ne(\alpha,n)^{25}Mg$ — $Q=-478$ keV

$^{22}Ne(\alpha,\gamma)^{26}Mg$ — $Q=10614.7$ keV

Need to determine the reaction rates for both channels



- High level density of ^{26}Mg
- Low value of energy and cross-section



- No data from direct measurements below 830 keV
- Discrepancies in indirect data
- Γ_α known only as UL

$^{22}Ne(\alpha,\gamma)^{26}Mg$ – The EASγ project

Purpose

Experimental study of $^{22}Ne(\alpha,\gamma)^{26}Mg$ in the energy range of astrophysical interest (600-900) keV

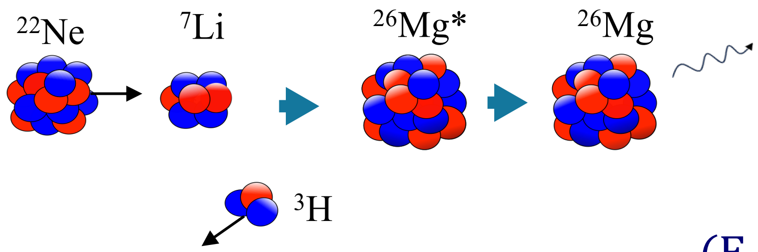
TRIUMF
$^{7}Li(^{22}Ne,t)^{26}Mg$

MC simulation

LUNA MV
$^{22}Ne(\alpha,\gamma)^{26}Mg$

$^{22}Ne(\alpha,\gamma)^{26}Mg$ with EASγ – Indirect measurement

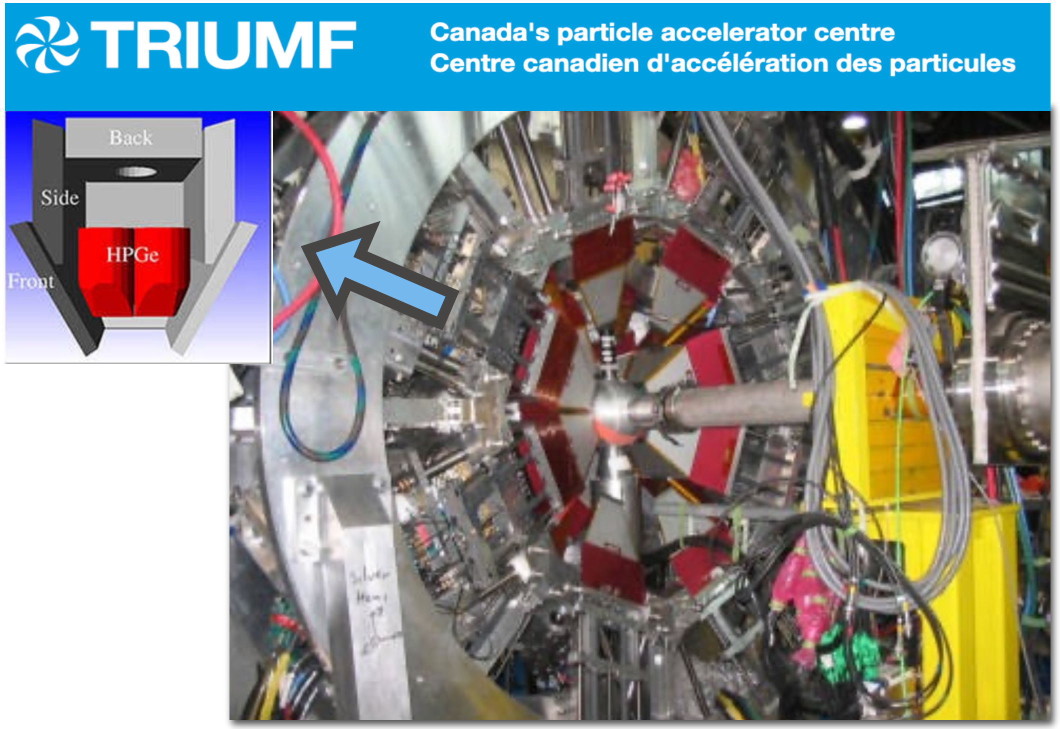
Study of ^{26}Mg states via $^{7}Li(^{22}Ne,t)^{26}Mg$ in inverse kinematics near α particle threshold



($E_x \simeq 11 MeV$)

^{26}Mg excited states will be reconstructed using triple coincidence detection:

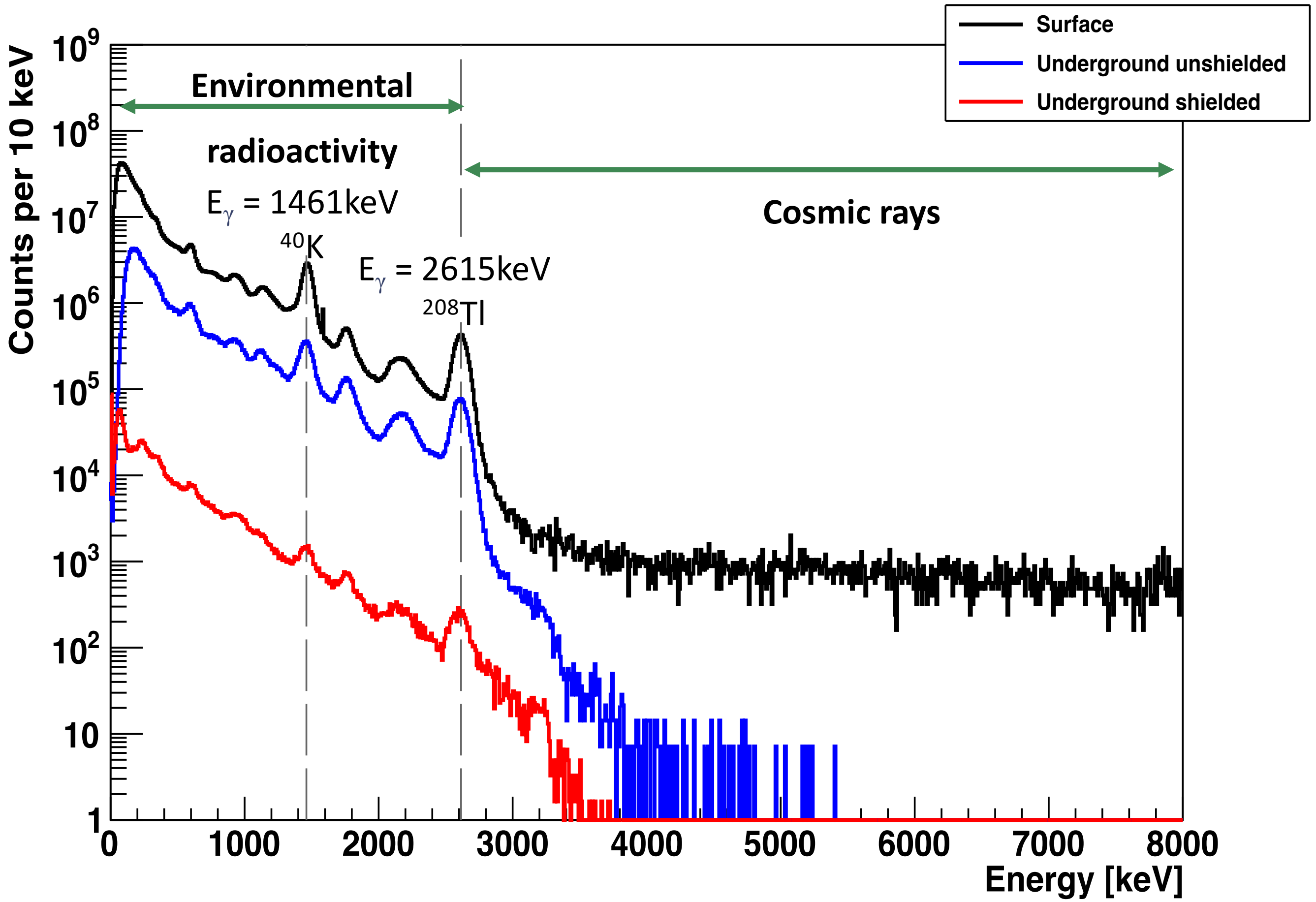
- gamma rays → TIGRESS
- heavy recoil → EMMA+IC
- light ejectile → Si detector

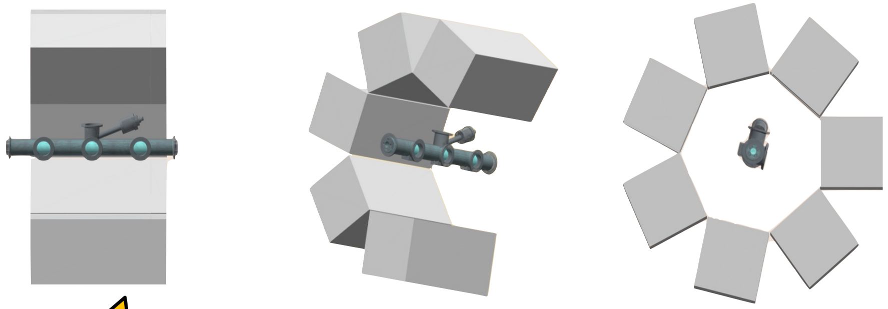


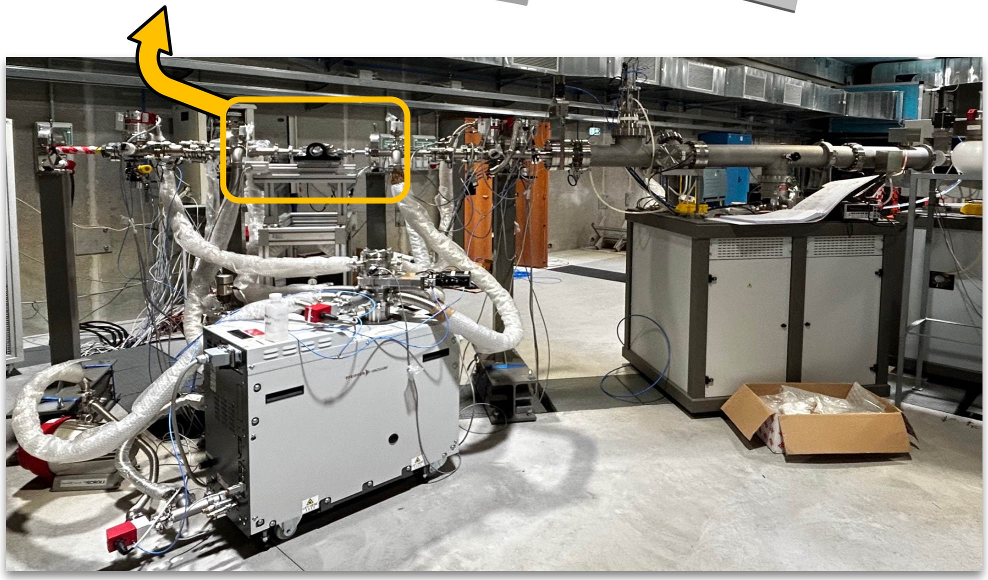
Observable	Level parameter
Kinetic energy of ^3H	Excitation energy of ^{26}Mg hence resonance energy
Shape of angular distribution	Constraint on spin parity of a level
Absolute value of angular distribution	ANC for bound states and Γ for unbound states

^{22}Ne(α, γ)^{26}Mg with EASγ – Direct measurement

Direct measurement of ^{22}Ne(α, γ)^{26}Mg in the range 600-900 keV deep underground



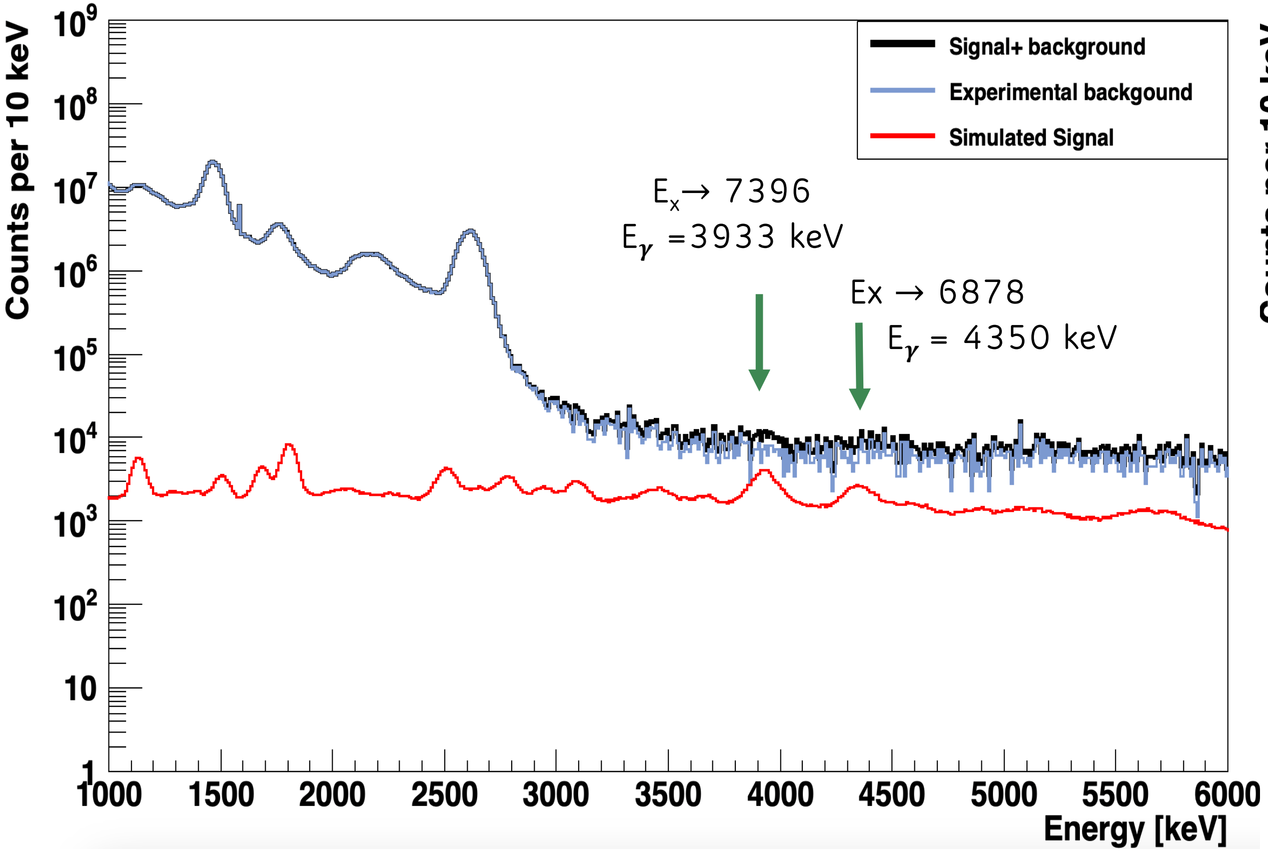


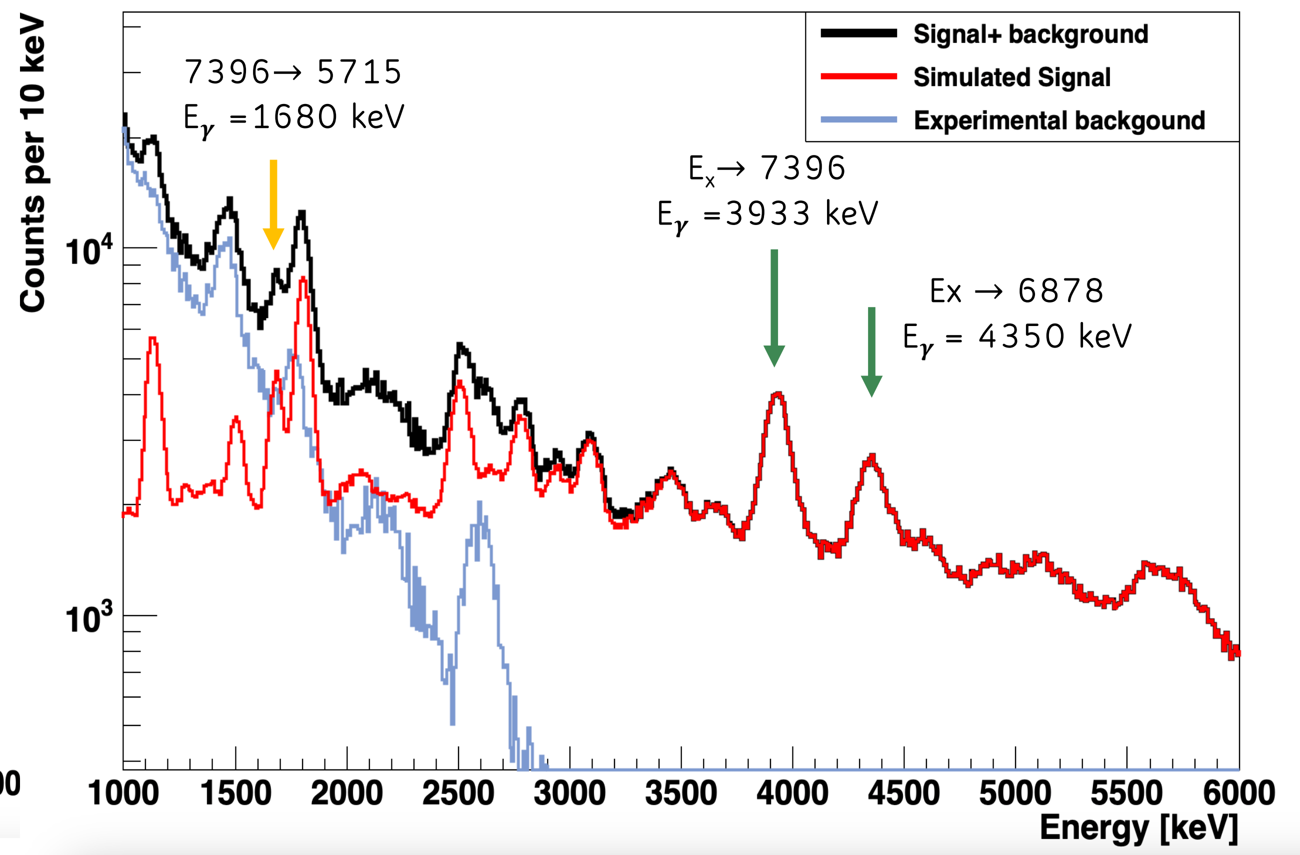


η_{FEP} = 10% for E_γ = 4 MeV

$^{22}Ne(\alpha,\gamma)^{26}Mg$ with EASγ – Ex =11329.1 keV

Surface vs underground measurements





THANKS FOR THE ATTENTION !

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