^{185}W(n, γ) Cross-sections Constrained with Statistical Nuclear Properties of ^{186}W nucleus.

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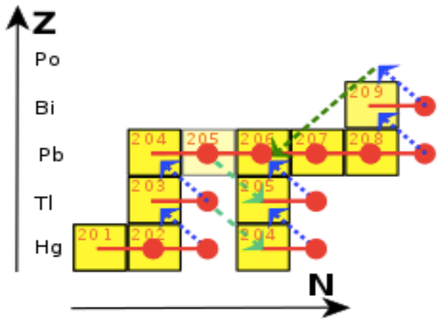
BACKGROUND

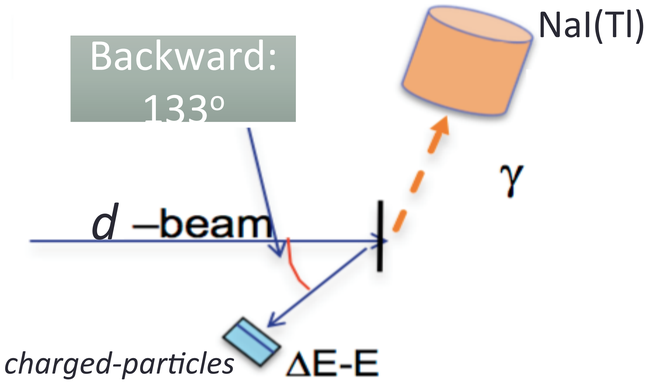
- It is a succession of (n, γ) reactions on stable nuclei with A > 56 until unstable nucleus is reached
- Along valley of beta-stability. Majority have $\lambda_\beta >> \lambda_{n\gamma}$



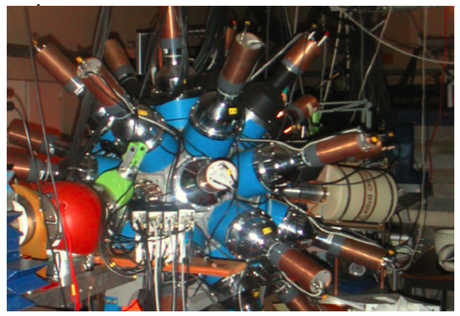
- There special cases with $\lambda_\beta = \lambda_{n\gamma}$
- These are called S-process branch point nuclei
- Three such branch points are ^{185}W, ^{186}Re, and ^{186}Os
- The ^{187}Re- ^{187}Os pair may be used as a cosmochronometer to determine the duration of the stellar nucleosynthesis before our solar system was formed.
- These analysis require experimental data for ^{185}W(n, γ) cross section

METHODS

- ^{186}W(d, *p*)^{187}W
- Target: 3.5 mg/cm^2 thick ^{186}W
- Beam: *d* @ 13 MeV and 0.5 – 0.7 pnA intensity

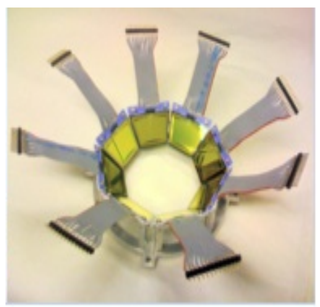


CACTUS ARRAY (26 NaI(Tl))



14.6 % efficiency @ 1.3 MeV
7% Resolution

64 Si ΔE-E detector



120 keV for d elestic peak

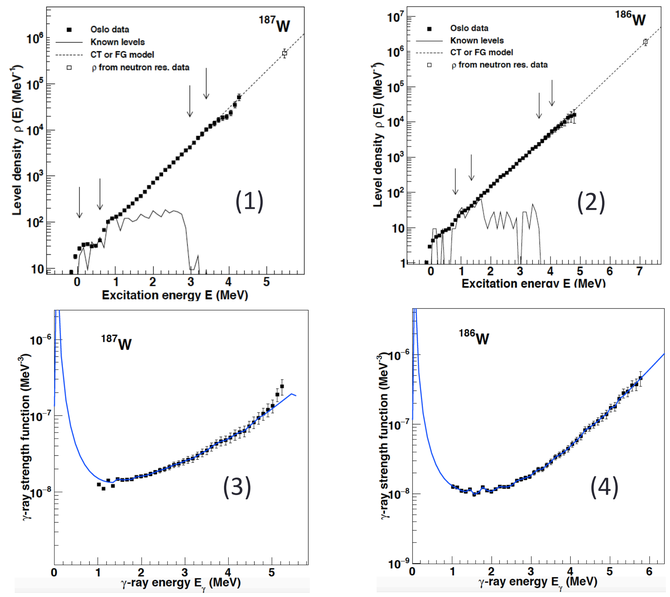
RESULTS

- Absolute values of NLD and γSF will extracted using the so-called Oslo Method
- Generation matrix constructed from unfolded γ spectra can be factorized as

$$P(E_x, E_\gamma) \propto \rho(E_f)\mathcal{T}(E_\gamma)$$

Nuclear level density (NLD) — γ transmission coefficient (γTC)

- Assuming E1 and M1 transitions: The γSF is obtained from $f(E_\gamma) = \frac{1}{2\pi}\frac{\mathcal{T}(E_\gamma)}{E_\gamma^3}$



- The nuclear level density is normalized to the level density of know discrete states which were taken from nndc.bnl.gov. They are also normalized to the level density at the neutron separation energy. This is obtained from neutron resonance spacing.
- The above data is currently being used to obtain the neutron capture reaction s of ^{185,186}W

OBJECTIVES

- Perform ^{186}W(d, X) @ 13 MeV
- Extract particle-γ coincidence of ^{186,187}W
- Extract γ strength function and Nuclear level density
- Use these to calculate ^{185,186}W(n, γ) using Hauser –Feshbach Model

RESULTS

- The γ strength function (γSF) and Nuclear level density (NLD) of ^{186,187}W are shown in figures 1, 2, 3 and 4.
- The neutron capture cross sections of ^{185,186}W calculated using NLD and γSF of ^{186,187}W in the Hauser Feshbach Model

SUMMARY

- The ^{185}W(n, γ) cross sections are required for the ^{187}Re- ^{187}Os a cosmochronometer
- The γSF and NLD of ^{186,187}W have been measured using the Oslo Method
- These will now be used to obtain the neutron capture cross sections in the Hauser Feshbach formalism