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$^{12}C+^{12}C$ Reaction at Low Energies

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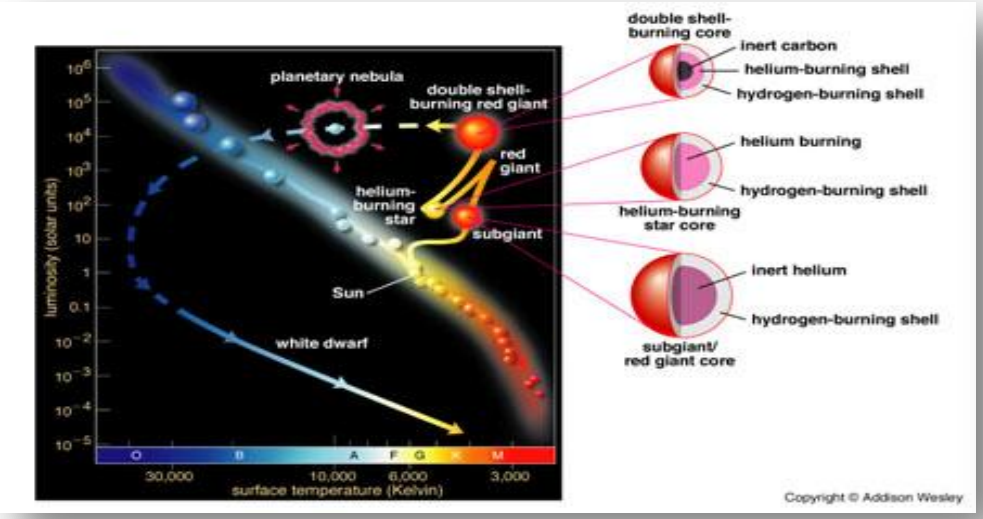
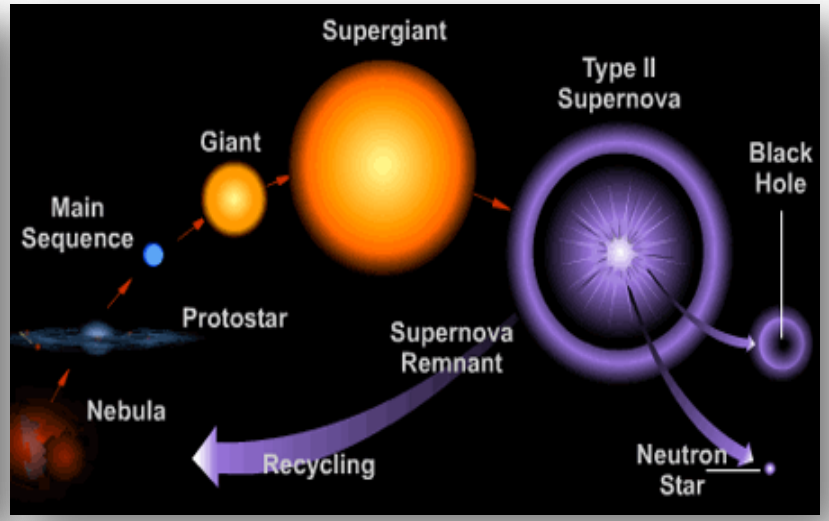
Astrophysical Motivation

Hydrostatic Burning

Every star goes through different stages according to its mass





- Extremely small stars: He white dwarf
- Small and intermediate stars ($0.4M_\Theta$–$4M_\Theta$): AGB stars
- Intermediate stars ($4M_\Theta$-$8M_\Theta$) : TP-AGB stars

- Stars with mass beyond $10M_\Theta$ in a supernovae explosion and end up as a black hole or neutron star.

- **In AGB and TP-AGB, improved knowledge on $^{12}C+^{12}C$ will help constrain the mass boundary during mass loss that affect AGB.**
- **Crucial Mass approximate: 8-10M_Θ and is dependant on the knowledge of the $^{12}C+^{12}C$ reaction**

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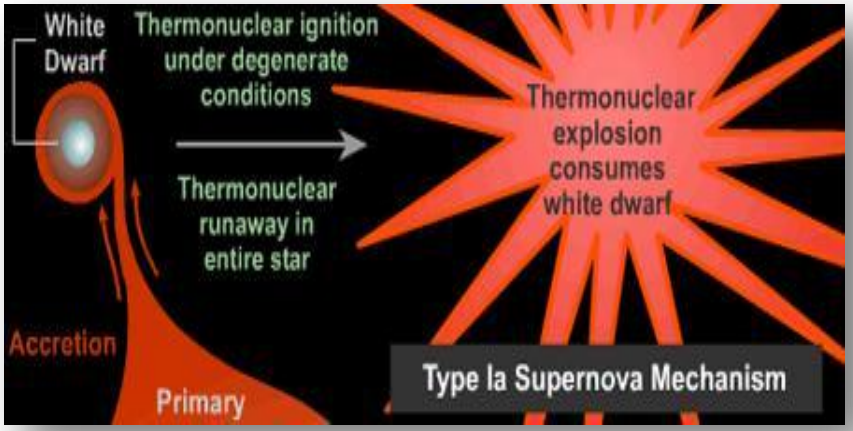
Astrophysical motivation

Binary system

Supernovae type Ia and Superburst



- Type Ia supernovae are referred to as standard candles for stellar distance determination.

- **Knowledge of $^{12}C+^{12}C$ which triggers type Ia supernovae will help understand its mechanism and timescale.**

- Superburst are similar to x-ray bursts but last two or three orders of magnitude longer.

- **There is an open question on whether the $^{12}C+^{12}C$ plays a role in superburst or not.**

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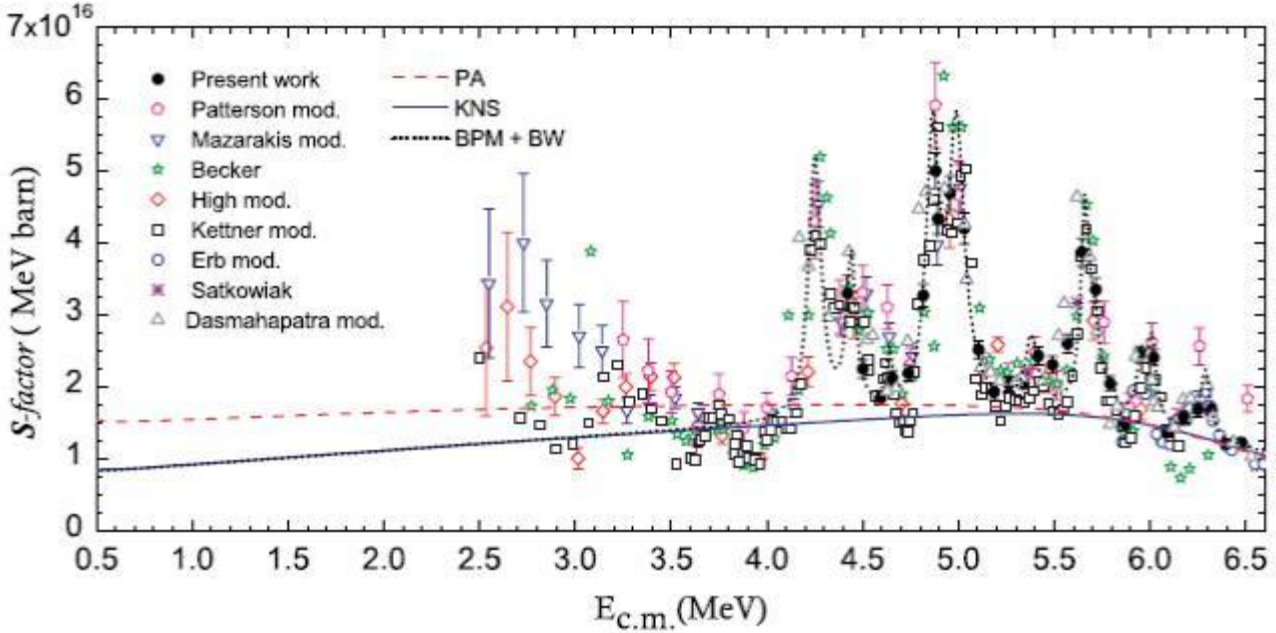
Previous $^{12}C+^{12}C$ measurements

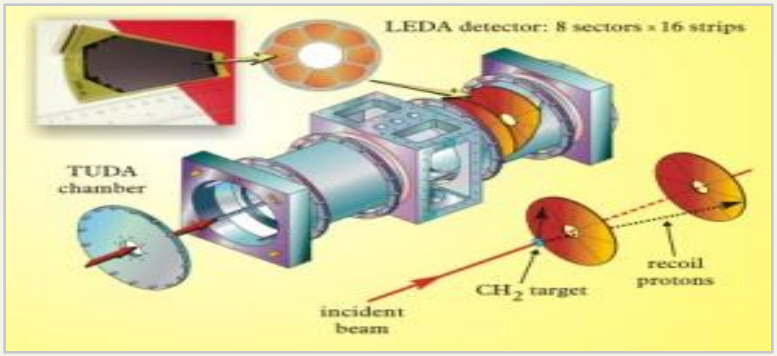


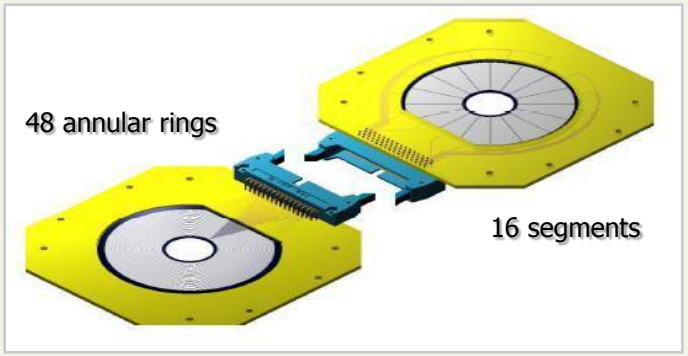
This figure by Aguilera et al. shows the S-factor for different $^{12}C+^{12}C$ experiments. Lines shows different theoretical predictions. Aguilera et al. , Physical Review C 73(2006) 064601

- The disagreement between measured data is clearly seen.
- Predictive power of theoretical models remain poor when extrapolating at low energies.

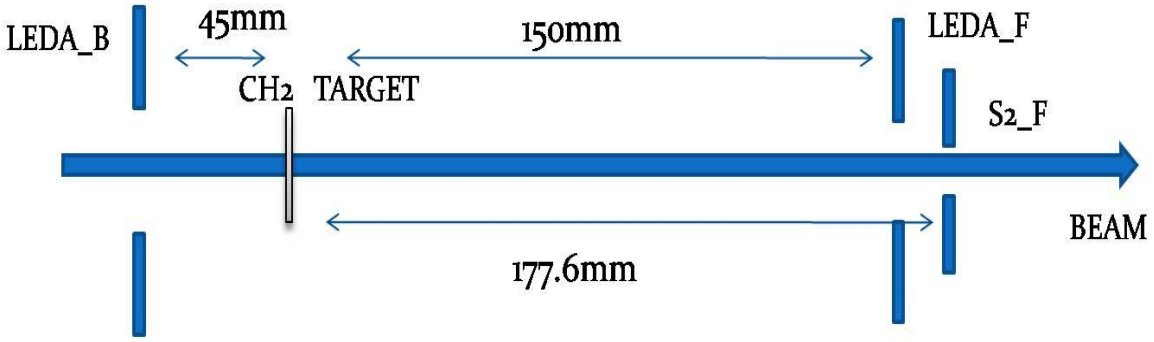
The experiment

The aim of this experiment was the determination of the total cross section. The experiment was based on charged particle detection: $^{12}C(^{12}C,\alpha)^{20}Ne$ and $^{12}C(^{12}C,p)^{23}Na$ at the centre of mass 3.4–4.02 MeV. $^{12}C^{3+}$ was used as beam with an intensity of 10 ^{11} pps. Enriched carbon of 10 or 20 ugcm ^{2} was used as target.





LEDA and S2 configuration were used for the experiment



Preliminary result

The parameters needed to be extracted are those corresponding to the variables required to calculate the differential cross section

I is the beam intensity

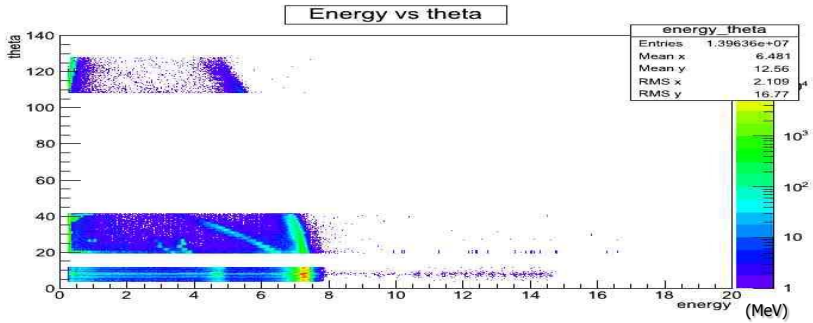
$d\Omega$ *is the* solid angle.

$$d\sigma/d\Omega = Y(E)/ I N(d\Omega lab \quad lab/com\ ratio)$$

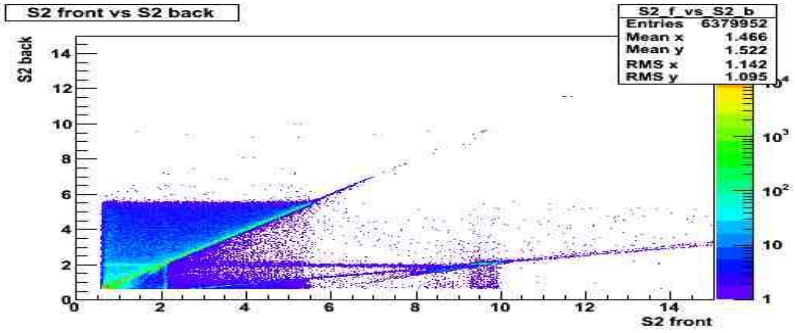
N is the number of target atom

Y(E) is the energy dependent yield

Currently working on extracting the yield:



- This figure shows the energy versus angle for the gold run without shield.
- Kinematics coupled with time of flight back of the S2 detector for the $^{12}C+^{12}C$ is used for particle identification.



- This figure shows the energy of the front of the S2 detector versus the energy for back of the S2 detector for the $^{12}C+^{12}C$.

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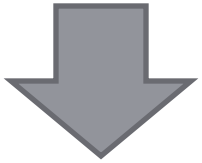
Conclusion

- **Analysis is ongoing**



FOR FURTHER DETAIL, VISIT MY POSTER

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Thanks very much for listening

Collaborators

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