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FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

Department of Physics

Measuring the $^{16}O+^{16}O$ Cross-Section

Hugo Silva
João Cruz
Adelaide Jesus
Cátia Santos
Hélio Luís
Micaela Fonseca
Luís Martins

FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

Hugo Silva

Hugo Miguel Martins Ferreira da Silva

Master's Degree in Biomedical Engineering.

João Duarte Neves Cruz

PhD in Nuclear Physics. Auxiliar Professor at Physics Department, FCT-UNL.

Objectives

In recent decades, the processes of fusion of ^{16}O were studied both theoretically and experimentally, because the fusion reaction $^{16}O+^{16}O$ is essential for understanding the nuclides burning processes in advanced stages of stellar evolution, contributing significantly to the production of heavier elements. Moreover, the study of this reaction is also central for understanding the processes of fusion of nuclides with intermediate mass. As results obtained to date are insufficient to understand how this reaction occurs in stars, the aim of this work is the detailed study of the fusion reaction $^{16}O+^{16}O$, especially at low energies below the Coulomb barrier.

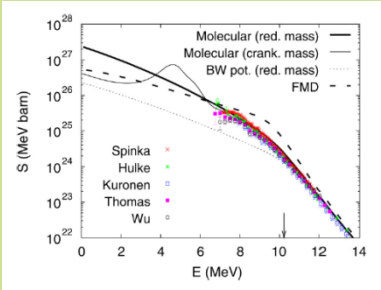

Fig.1)The S-factor as a function of the center-of-mass energy for $^{16}O+^{16}O$.

Methodology

These reactions occur well below the Coulomb barrier and therefore the cross sections are very low (on the order of nanobarn), which makes the study and experimental analysis a demanding task.
In order to exceed these limitations, it is essential to build a new experimental setup that includes last generation detectors such as the silicon detector E-ΔE.
The targets will be made of anodized tantalum sheets. These targets should be well characterized and stable with an accurate stoichiometry.
This work will be accomplished at IST-CTN Laboratory, using the 3 MV Tandem accelerator.

Fig.2) Tandem accelerator located at IST-CTN Laboratory.

Expected Results

The great disparity between the three theoretical models, as shown in figure 1, justifies a experimental measure of the fusion reaction $^{16}O+^{16}O$ at low energies (between 4 and 6.5 MeV) in order to evaluate the pace of the cross-section at low energies.
Other important question to be answered is the fact that this reaction has many exit channels, so it is also important to measure the cross-sections of the several reaction channels and the ratio between 3-body cross-sections and the total cross-section.
At the end of this work, a comprehensive picture of the fusion mecanism should be obtained.

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