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Study of 20Ne spectroscopy from new experiments on 19F(p,a0) and A New Phenomenological Model for the description of Heavy-Ion Fusion Cross Sections

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In this contribution we will discuss new results obtained by performing high precision experiments of proton induced transmutation of fluorine in direct kinematics, with the aim of studying both the α_0 and α_π reaction channels, leading respectively to the 16O residual nucleus in the ground and the first excited states. This reaction has been subject of a large interest in recent times, both as a tool to investigate the occurrence of clustering of the 20Ne compound nucleus here formed, and for its involvement in exotic nuclear astrophysics context linked to studies of CNOF breakout reactions.

The experiment was performed at the Singletron electrostatic accelerator in Catania (Italy) by colliding a proton beam of energies Ep=1.15-1.34 MeV and Ep=1.64-1.74 MeV onto a calcium fluoride layer deposited on a thin carbon backing. The detection system was made by an high resolution solid state detector, placed onto a movable arm allowing a very accurate geometrical positioning. The bombarding energy region here investigated would allow (1) to solve conflicting estimates previously reported in the literature for the α_0 channel and (2) to investigate for the first time the astrophysical factor of the α_π channel in a region where no data are reported in the literature. The excellent angular and energy resolutions allowed us to perform an internal normalization procedure to estimate the absolute cross sections, based on the analysis of the elastic scattering signals. We will therefore discuss the preliminary results obtained from this investigation, with a particular emphasis on the impact of such new data on the structure of 20Ne in the 13 MeV excitation energy region.

Primary author: LOMBARDO, Ivano (INFN Sezione di Catania)

Presenter: LOMBARDO, Ivano (INFN Sezione di Catania)

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