Study of Nuclear Structure in the Sn Region via (p,t) Reactions. ◇

A. Covello [a], A. Gargano [a], P. Guazzoni [b], L. Zetta [b], M. Jaskola [c], A. Gollwitzer, R. Hertenberger, A. Metz, B. D. Valnion, and G. Graw

[a] Dipartimento di Scienze Fisiche dell'Università and I.N.F.N., I-80125 Napoli, Italy

[b] Dipartimento di Fisica dell'Università and I.N.F.N., I-20133 Milano, Italy

[c] Soltan Institute of Nuclear Studies, Swierk, Poland

The Sn isotopes have long been the subject of both experimental and theoretical studies. This is related to the fact that they provide the opportunity to study the effect of adding neutrons to a doubly-magic core over a large number of nuclei.

Any microscopic calculation for the Sn isotopes is based on the shell model, where it is generally assumed that most of the lowest states of these nuclei can be described as excitations of the valence neutrons outside the ^{100}Sn inert core restricted to the five single-particle states 1g7/2, 2d5/2, 2d3/2, 3s1/2, and h11/2. This model space, however, is already exceedingly large if one wants to study nuclei with more than six or eight valence neutrons. It is therefore necessary to resort to further simplifications. In single-closed-shell nuclei, such as the Sn isotopes, the seniority scheme provides a very valuable tool to reduce the model-space dimensions. There is in fact clear evidence that only states with low seniority play a significant role in the description of the low-energy spectra of these nuclei.

A very effective way to carry out seniority-truncated calculations is provided by a new approach to shell-model problems, the chain-calculation method [1]. Within a given seniority truncation this method allows a large reduction in the size of the energy matrices without any significant loss in the accuracy of the results. In our calculations for the even Sn isotopes we include states with seniority up to 4.

Recently, shell-model calculations with realistic effective interactions have been performed for the neutron-deficient isotopes [2]. These calculations are now being extended to the whole isotopic chain with the aim of assessing the role of realistic effective interactions in medium- and heavy-mass nuclei. In this regard, the discovery of new low-energy levels in the Sn isotopes is of great relevance. Of special interest are the two isotopes ^{112}Sn and ^{114}Sn for which a weak shell closure, corresponding to the filling of the d5/2 and g7/2 s.p. levels, seems to exist.

We have collected test spectra at few angles for the ^{116,114}Sn(p,t)^{114,112}Sn reactions, at 25 MeV incident energy, using the proton beam of the Munich tandem accelerator. The outgoing tritons have been analyzed with the Q3D magnetic spectrograph and detected with the high resolution 1.7 m focal plane detector. ^{116,114}Sn targets have been used with a thickness of 0.153 mg/cm^2 (highly enriched) and 0.164 (66 % enriched) mg/cm^2, respectively.

The spectrum for the reaction ^{116}Sn(p,t)^{114}Sn is shown, collected at $\theta_{lab} = 30^o$ and combining three different magnetic settings up to an excitation energy of 3.2 MeV.

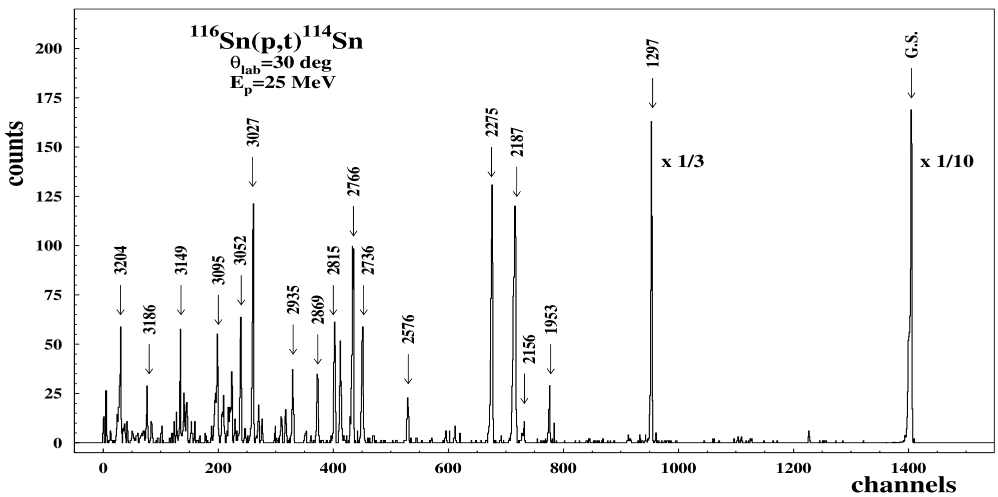
The energy calibration has been done on the basis of the adopted level scheme [3]. The average resolution obtained is ~8 keV, restricted mainly due to the target thickness.

References

[1] A. Covello, F. Andreozzi, L. Coraggio, A. Gargano, and A. Porrino, in New Perspectives in Nuclear Structure, Proceedings of the Fifth International Spring Seminar on Nuclear Physics, Ravello, 1995, edited by A. Covello (World Scientific, Singapore, 1996), p. 147.

[2] F. Andreozzi, L. Coraggio, A. Covello, A. Gargano, T.T.S. Kuo, Z.B. Li, and A. Porrino, Phys.Rev. **C54** (1996) 1636

[3] J. Blachot and G.Marguier, NDS **75** (1995) 739



◇ Work supported by the DFG under IIC4-Gr 894/2.