Spectroscopy of ^{24}Na via (d,p) ◇

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In the frame of our complex and complete spectroscopy of ^{24}Na [1], the ^{23}Na(d,p) experiment at E_d=24 MeV was performed at the Tandem accelerator and the Q3D magnetic spectrograph [2]. Energies and intensities of protons were measured with the 1.7 m long focal plane detector [3].

Attention was paid to the separation of Na lines from background in the resulting spectra. We accumulated spectra from the measurements with three targets, NaF (80 μg/cm^2), NaI(110 μg/cm^2) and NaCl(80 μg/cm^2) on 4.2 μg/cm^2 carbon backing. Moreover, we measured the NaF target at two angles, at 25° and 50°. In addition to the level energies, we deduced the differential cross section of these levels for 25° and 50°. The absolute intensities of Na lines were normalized to the beam current measured by a Faraday cup. An example of a (d,p) spectrum with the NaF target is shown in fig. 1.

The level energies of ^{24}Na were obtained from the NaF measurements up to an excitation energy of 6 MeV. The calibration of the spectra up to 5.42 MeV was accomplished utilizing the level energies from the thermal neutron capture reaction [4]. Beyond that energy, fluorine lines [5] were used for calibration.

The achieved resolution of 8 keV (FWHM) made it possible to improve the level energies of excited states compared to previous measurements with light ions [4]. In the present study, we confirmed six levels reported in a previous (d,p) measurement [6] which were not adopted in the newest compilation for ^{24}Na [4]. Besides, we propose six new levels.

A comprehensive investigation of the nuclear structure of ^{24}Na, will include our new (d,p) results and the new (n,γ) data. It will be published together with detailed theoretical calculations.

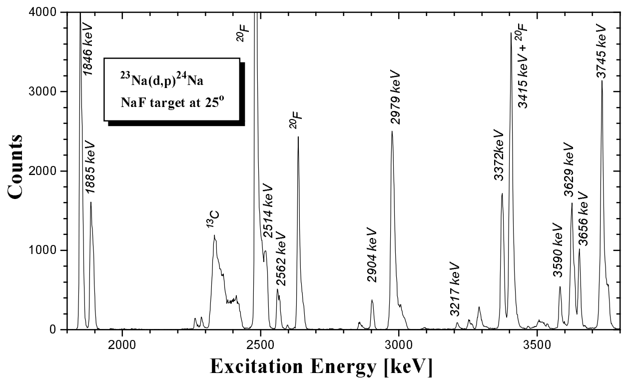

Fig. 1: Part of the (d,p) spectrum with the NaF target at 25°.

References

[1] S. Raman, private communication.
[2] M. Löffler, H.-J. Scheerer and H. K. Vonach, Nucl. Instr. Meth. **111** (1973) 1
[3] E. Müller-Zanotti, M. Bisenberger, R. Hertenberger, H. Kader and G. Graw, Nucl. Instr. Meth. **A310** (1991) 706
[4] Table of Isotopes, 8th edition, edited by R. B. Fireston, V. S. Shirley, S. Y. F. Chu, C. M. Baglin and J. Zipkin, John Wiley & Sons Inc., New York, 1996.
[5] S. Raman *et al.*, Phys. Rev. **C53** (1996) 616
[6] C. Daum, Nucl. Phys. **45** (1963) 273

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