^{9}Be(^{27}F,^{26}O), C(^{27}F,^{26}O) 2016Ko11,2013Ko10,2013Ca18

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia and A. M. Hurst	NDS 134, 1 (2016)	1-Feb-2016

Others: 2015Ko08, 2013Th04, 2012Lu07.

2016Ko11: ^{27}F beam was produced by fragmentation of ^{48}Ca primary beam, E=345 MeV/nucleon, on a Be target at the RIKEN Nishina Center and Center for Nuclear Study, University of Tokyo. The fragments were separated by BigRIPS separator and ^{27}F secondary beam bombarded a C (thickness 1.8 g/cm^2) target with mean energies of 201-MeV/nucleon (mid target). The impact position on the target and incident angles of beam particles determined event by event using two multiwire drift chambers (MWDCs). The decay products, ^{24}O and two neutrons were measured in coincidence using a magnetic spectrometer, SAMURAI, for momentum analysis of charged particles and by plastic scintillator array, NEBULA, consists of 120 detector modules and 24 charged particle veto detectors, respectively. The trajectories of the charged fragments were determined using two MWDCs and a 16 element plastic scintillator hodoscope was used for energy loss and time-of-flight measurements. ^{26}O decay-energy spectrum from one-proton removal of ^{27}F reconstructed from momentum vectors of ^{24}O and two neutrons. Deduced g.s. and first excited state of ^{26}O using invariant-mass spectroscopy.

2013Ko10,2012Lu07,2015Ko08: ^{9}Be(^{27}F,^{26}O) – E(^{27}F)=82 MeV/nucleon beam obtained from fragmentation of ^{48}Ca beam, E=140 MeV/nucleon, with a 1316 mg/cm^2 thick ^{9}Be target. ^{27}F fragments separated by A1900 fragment separator. Secondary reaction target was 705 mg/cm^2 thick ^{9}Be. The ^{26}O to ^{24}O+n+n decay was investigated through the identification of charged particles in mass, charge, kinetic energy, and angle by a 4 Tm dipole magnet, and detection of neutrons by MoNA array placed 6.05 m from the reaction target. Measured E(n), I(n), (^{24}O)nn-triple coin; deduced decay energy spectrum and half-life of ^{26}O decay from the analysis of three-body decay energy of ^{24}O+n+n system, and detailed Monte-Carlo simulations. The invariant mass of ^{26}O was extracted from the experimentally measured four-momenta of the ^{24}O and two neutrons. Comparison with theoretical predictions.

2013Ca18: C(^{27}F,^{26}O) – ^{27}F beam, E=414–MeV/nucleon, produced via fragmentation of a 490-MeV/nucleon ^{40}Ar primary beam in a 4 g/cm^2 Be target using the R3B-LAND reaction setup at GSI. Neutron-unbound states in ^{26}O were populated via one-proton knockout of ^{27}F on different secondary targets: 922 mg/cm^2 CH_2, 935 mg/cm^2 C, and 2145 mg/cm^2 Pb. The secondary target was surrounded by the 4π Crystal Ball detector comprising 160 NaI elements for photon and light-particle detection. Energy-loss and position measurements for charged beam particles accomplished using two silicon-strip detectors behind the target. Ions identified through time of flight and energy-loss measurements. Neutrons detected 12 m downstream of the target using the LAND neutron detector with 92% single-neutron efficiency. Deduced unbound states of ^{26}O and mean lifetime.

^{26}O Levels

E(level)	J$^\pi$	T$_{1/2}$	Comments
0.0	0$^+$	4.5 ps *+32−34*	%2n=100. E(level): 2016Ko11 deduced g.s of ^{26}O as unstable to 2-neutron emission, with an adopted resonance value of 18 keV *10* (stat) *4* (syst). from their measurements. Considering different modes of decay and assumptions, 2016Ko11 deduced resonance energy values of 22 keV *+14−11*, 18 keV *3* (stat), 19 keV *3* (stat), 17 keV *3* (stat), 19 keV *+3−4* and conclude that the resonance energy (g.s.) is model independent. FWHM 110 keV at 20 keV (2016Ko11). 2013Ca18 deduced g.s. of ^{26}O as unstable to 2-neutron emission, with measured resonance energy of ≤120 keV at 95% C.L. and ≤40 keV at 68% C.L. 2015Ko08 extracted an upper limit at 1σ of 53 keV for the ground-state resonance energy of ^{26}O from simultaneous and self-consistent fitting of the experimental decay energy and the Jacobi three-body correlation variables. Their earlier value 150 *+50−150* (2012Lu07) was deduced from fit of the experimental three-body decay spectrum with a Monte Carlo simulation including the decay from the ground state and first excited state. T$_{1/2}$: From 2013Ko10. Half-life of 4.5 ps *+11−15* (stat) *30* (syst) is deduced at 82% confidence level, suggesting the possibility of two-neutron radioactive decay. Evaluators added the uncertainties in quadrature. In 2013Ko10, fitting of relative velocity distribution of ^{24}O and each of the two neutrons with a Monte Carlo simulation and as function of the half-life parameter, with the consideration whether decay of ^{26}O occurs in the reaction target or outside the target. Other values: ≤4.0 ns, from mean lifetime of τ≤5.7 ns (2013Ca18) at 95% C.L.; <10 fs (2013Th04). Measured cross section=1.8 mb *10* (2012Lu07) for population of the ^{26}O g.s.

Continued on next page (footnotes at end of table)

$^{9}Be(^{27}F,^{26}O)$, $C(^{27}F,^{26}O)$ 2016Ko11,2013Ko10,2013Ca18 (continued)

^{26}O Levels (continued)

E(level)	J^{π}	Comments
1277 *96*	2^+	J^{π}: 2016Ko11 propose as the first excited state of ^{26}O. E(level): From E_{res}=1280 keV *+110−80* (2016Ko11 list as 1.28 MeV *+11−8*). Compiler used E_{res}=1295 keV *95*, with symmetric uncertainty, to deduce the excited level energy. FWHM 540 keV at 1300 keV. 2016Ko11 note that the systematic uncertainty associated with the excited state decay energy is negligible compared to the statistical uncertainty.
2×10^3?[†]		E(level): From 2013Ko10, resonance energy at approximately 2 MeV from Figure 1 in 2013Ko10. Note that position of this state in Figure 1 is based on predictions from the continuum shell model calculations. Possible first excited state.
4.23×10^3[†] *20*		E(level): Deduced by evaluator from measured E_r=4225 keV *+227−176* (2013Ca18) and considering E_{res}=18 keV *10* (stat) *4* (syst) for g.s. Evaluator used E_{res}=4250 keV *200*, with symmetric uncertainty, to deduce the excited level energy.

[†] 2016Ko11 note that no resonance like structure at higher energies reported by 2013Ca18 was observed.