^{58}Ni(n,γ):resonances 2014Zu01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 151, 1 (2018)	1-Apr-2018

Others: 2014Le19, 2010Gu19.

Target=^{58}Ni sample (supplied by Chemotrade) had a mass of 2.069 g, a diameter of 19.91 mm, thickness of 0.72 mm and an enrichment of 99.5%, with impurities reported as 0.48% ^{60}Ni, 0.01% ^{61}Ni, and 0.005% of both ^{62}Ni and ^{64}Ni. Study conducted at the neutron time-of-flight facility n_TOF at CERN. Neutrons produced by pulsed beam of 20 GeV/c protons hitting a cylindrical lead (Pb) target. On average, 300 neutrons are produced per proton, resulting in 2×10^{15} neutrons per pulse. Typical beam conditions are a repetition rate in multiples of 1.2 s and a proton pulse width of 7 ns. Prompt capture γ rays detected by two optimized C_6D_6 liquid scintillation detectors.

^{59}Ni Levels

E(level)[†‡]	J$^\pi$[#]	L[#]	K (meV)[@]	Comments
9006.0548 *6*	1/2	1	20 *2*	E(n)(Lab)=6.8927 keV *6*. K_{unc}=*2*$_{stat}$ and *1*$_{syst}$.
9011.680 *1*	1/2	1	25 *4*	E(n)(Lab)=12.616 keV *1*. K_{unc}=*4*$_{stat}$ and *1*$_{syst}$.
9012.3452 *6*	1/2	1	601 *21*	E(n)(Lab)=13.2927 keV *6*. K_{unc}=*21*$_{stat}$ and *33*$_{syst}$.
9012.6585 *3*	3/2	1	591 *17*	E(n)(Lab)=13.6114 keV *3*. K_{unc}=*17*$_{stat}$ and *33*$_{syst}$.
9014.367 *7*	1/2	0	1279 *41*	E(n)(Lab)=15.350 keV *7*. K_{unc}=*41*$_{stat}$ and *71*$_{syst}$.
9016.186 *2*	1/2	1	38 *9*	E(n)(Lab)=17.200 keV *2*. K_{unc}=*9*$_{stat}$ and *2*$_{syst}$.
9017.931 *2*	5/2	2	71 *10*	E(n)(Lab)=18.976 keV *2*. K_{unc}=*10*$_{stat}$ and *4*$_{syst}$.
9018.925 *1*	1/2	1	256 *18*	E(n)(Lab)=19.987 keV *1*. K_{unc}=*18*$_{stat}$ and *14*$_{syst}$.
9020.0239 *8*	3/2	1	663 *27*	E(n)(Lab)=21.1051 keV *8*. K_{unc}=*27*$_{stat}$ and *37*$_{syst}$.
9024.859 *2*	3/2	1	263 *25*	E(n)(Lab)=26.024 keV *2*. K_{unc}=*25*$_{stat}$ and *15*$_{syst}$.
9025.421 *1*	3/2	1	864 *40*	E(n)(Lab)=26.596 keV *1*. K_{unc}=*40*$_{stat}$ and *48*$_{syst}$.
9026.381 *4*	1/2	1	33 *14*	E(n)(Lab)=27.573 keV *4*. K_{unc}=*14*$_{stat}$ and *2*$_{syst}$.
9030.936 *3*	5/2	2	388 *39*	E(n)(Lab)=32.207 keV *3*. K_{unc}=*39*$_{stat}$ and *21*$_{syst}$.
9031.064 *3*	1/2	1	1120 *74*	E(n)(Lab)=32.337 keV *3*. K_{unc}=*74*$_{stat}$ and *62*$_{syst}$.
9032.873 *3*	3/2	1	689 *67*	E(n)(Lab)=34.178 keV *3*. K_{unc}=*67*$_{stat}$ and *38*$_{syst}$.
9034.736 *3*	1/2	0	1020 *90*	E(n)(Lab)=36.073 keV *3*. K_{unc}=*90*$_{stat}$ and *56*$_{syst}$.
9038.096 *3*	3/2	2	719 *62*	E(n)(Lab)=39.492 keV *3*. K_{unc}=*62*$_{stat}$ and *40*$_{syst}$.
9042.480 *4*	5/2	2	123 *26*	E(n)(Lab)=43.952 keV *4*. K_{unc}=*26*$_{stat}$ and *7*$_{syst}$.
9046.284 *3*	3/2	1	1128 *87*	E(n)(Lab)=47.822 keV *3*. K_{unc}=*87*$_{stat}$ and *62*$_{syst}$.
9050.232 *5*	5/2	2	780 *87*	E(n)(Lab)=51.839 keV *5*. K_{unc}=*87*$_{stat}$ and *43*$_{syst}$.
9050.530 *4*	3/2	2	830 *80*	E(n)(Lab)=52.142 keV *4*. K_{unc}=*80*$_{stat}$ and *46*$_{syst}$.
9053.055 *3*	3/2	2	235 *44*	E(n)(Lab)=54.711 keV *3*. K_{unc}=*44*$_{stat}$ and *13*$_{syst}$.
9056.894 *4*	3/2	1	570 *62*	E(n)(Lab)=58.617 keV *4*. K_{unc}=*62*$_{stat}$ and *32*$_{syst}$.
9058.319 *7*	3/2	1	606 *79*	E(n)(Lab)=60.067 keV *7*. K_{unc}=*79*$_{stat}$ and *34*$_{syst}$.
9059.930 *7*	1/2	1	11.2×10^2[&] *12*	E(n)(Lab)=61.706 keV *7*. K_{unc}=*123*$_{stat}$ and *62*$_{syst}$. K=1115 meV.
9060.9 *2*	1/2	0	26.2×10^2[&] *25*	E(n)(Lab)=62.7 keV *2*. K_{unc}=*248*$_{stat}$ and *145*$_{syst}$. K=2621 meV.
9064.523 *6*	3/2	1	565 *78*	E(n)(Lab)=66.379 keV *6*. K_{unc}=*78*$_{stat}$ and *31*$_{syst}$.
9066.6772 *8*	3/2	2	205 *53*	E(n)(Lab)=68.5706 keV *8*. K_{unc}=*53*$_{stat}$ and *11*$_{syst}$.
9067.898 *9*	1/2	1	529 *76*	E(n)(Lab)=69.813 keV *9*. K_{unc}=*76*$_{stat}$ and *29*$_{syst}$.
9075.951 *6*	1/2	1	238 *57*	E(n)(Lab)=78.006 keV *6*. K_{unc}=*57*$_{stat}$ and *13*$_{syst}$.
9079.107 *1*	3/2	2	10.2×10^2[&] *15*	E(n)(Lab)=81.217 keV *1*. K_{unc}=*146*$_{stat}$ and *48*$_{syst}$.
9080.63 *1*	3/2	1	15.3×10^2[&] *19*	E(n)(Lab)=82.77 keV *1*. K_{unc}=*193*$_{stat}$ and *71*$_{syst}$.
9081.123 *8*	1/2	0	5.7×10^2[&] *13*	E(n)(Lab)=83.268 keV *8*. K_{unc}=*133*$_{stat}$ and *27*$_{syst}$. K=571 meV.
9081.64 *1*	1/2	1	12.8×10^2[&] *17*	E(n)(Lab)=83.79 keV *1*. K_{unc}=*169*$_{stat}$ and *59*$_{syst}$. K=1278 meV.
9082.632 *4*	3/2	2	234 *77*	E(n)(Lab)=84.803 keV *4*. K_{unc}=*77*$_{stat}$ and *11*$_{syst}$.
9087.575 *9*	3/2	1	7.1×10^2[&] *13*	E(n)(Lab)=89.832 keV *9*. K_{unc}=*128*$_{stat}$ and *33*$_{syst}$. K=705 meV.
9093.2028 *5*	5/2	2	10.3×10^2[&] *18*	E(n)(Lab)=95.5580 keV *5*. K_{unc}=*175*$_{stat}$ and *48*$_{syst}$. K=1025 meV.
9094.473 *6*	5/2	2	6.1×10^2[&] *14*	E(n)(Lab)=96.850 keV *6*. K_{unc}=*137*$_{stat}$ and *28*$_{syst}$. K=606 meV.
9095.07 *2*	1/2	1	434 *93*	E(n)(Lab)=97.46 keV *2*. K_{unc}=*93*$_{stat}$ and *20*$_{syst}$.
9098.802 *7*	5/2	2	1011 *98*	E(n)(Lab)=101.255 keV *7*. K_{unc}=*98*$_{stat}$ and *47*$_{syst}$.

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^{58}Ni(n,γ):resonances 2014Zu01 (continued)

^{59}Ni Levels (continued)

E(level)[†‡]	J^{π}[#]	L[#]	K (meV)[@]	Comments
9102.772 *7*	3/2	2	23.2×10^2 *14*	E(n)(Lab)=105.294 keV *7*. K_{unc}=*144*$_{stat}$ and *108*$_{syst}$.
9104.442 *7*	1/2	1	5.1×10^2[&] *11*	E(n)(Lab)=106.993 keV *7*. K_{unc}=*105*$_{stat}$ and *23*$_{syst}$. K=506 meV.
9105.078 *8*	3/2	2	15.5×10^2[&] *16*	E(n)(Lab)=107.640 keV *8*. K_{unc}=*156*$_{stat}$ and *72*$_{syst}$. K=1549 meV.
9105.87 *8*	1/2	0	22.6×10^2[&] *23*	E(n)(Lab)=108.45 keV *8*. K_{unc}=*232*$_{stat}$ and *105*$_{syst}$. K=2256 meV.
9108.014 *7*	3/2	1	9.9×10^2[&] *11*	E(n)(Lab)=110.627 keV *7*. K_{unc}=*113*$_{stat}$ and *46*$_{syst}$. K=993 meV.
9108.7292 *2*	5/2	2	697 *31*	E(n)(Lab)=111.3547 keV *2*. K_{unc}=*31*$_{stat}$ and *32*$_{syst}$.
9113.708 *4*	1/2	1	180 *58*	E(n)(Lab)=116.420 keV *4*. K_{unc}=*58*$_{stat}$ and *8*$_{syst}$.
9114.94 *1*	3/2	1	11.9×10^2[&] *12*	E(n)(Lab)=117.67 keV *1*. K_{unc}=*116*$_{stat}$ and *55*$_{syst}$. K=1185 meV.
9116.857 *8*	5/2	2	23.4×10^2[&] *21*	E(n)(Lab)=119.624 keV *8*. K_{unc}=*211*$_{stat}$ and *108*$_{syst}$. K=2338 meV.
9118.168 *8*	1/2	1	3.3×10^2[&] *12*	E(n)(Lab)=120.958 keV *8*. K_{unc}=*118*$_{stat}$ and *15*$_{syst}$. K=332 meV.
9118.46 *1*	3/2	2	13.8×10^2[&] *16*	E(n)(Lab)=121.25 keV *1*. K_{unc}=*163*$_{stat}$ and *64*$_{syst}$. K=1377 meV.

[†] Excitation energies obtained from E(n)(c.m. system)+S(n)(^{59}Ni), where S(n)(^{59}Ni)=8999.28 *5* (2017Wa10: AME-2016). E(n)(c.m. system)=E(n)(lab)[mass of ^{58}Ni)/(mass of neutron+mass of ^{58}Ni)]. Relative uncertainties are given here with respect to those in neutron energies. For absolute uncertainty in excitation energy add 0.05 keV in quadrature; this uncertainty dominates for most levels. These excitation energies from neutron resonances are not listed in the Adopted Levels.

[‡] Resolved neutron capture resonances, as recorded in the paper, are given as comments to each energy level.

[#] Quoted 2014Zu01 from ENDF/B-VII.1 parameters database.

[@] $K=g_s\Gamma_n\Gamma_\gamma/(\Gamma_n+\Gamma_\gamma)$. Since the measured resonance widths were in most cases larger than the natural widths due to Doppler broadening and other issues relating to the experimental set-up only the capture kernel (K) could be determined as defined by equation 3 in the paper $K=g_s\Gamma_n\Gamma_\gamma/(\Gamma_n+\Gamma_\gamma)$ with $g_s=(2J+1)/[(2J_n+1)(2J_{58Ni}+1)]$ as defined by equation 4 in the paper, which reduces to $g_s=(2J+1)/2$ for J=spin of resonance state, J_n=1/2, and J^π(^{58}Ni)=0. Statistical (stat) and systematic (syst) uncertainties are listed in 2014Zu01. Evaluator lists only statistical uncertainties, while both (stat) and (syst) uncertainties are listed in comment section.

[&] Kernel was rounded by evaluator to fit magnitude of uncertainty into column. Measured capture kernel is given in comments.