The Abdus Salam International Centre for Theoretical Physics

2358-4

Joint ICTP-IAEA Workshop on Nuclear Structure Decay Data: Theory and Evaluation

6 - 17 August 2012

XUNDL

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Compilation of current Experimental Nuclear Structure and Decay papers: XUNDL database

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IAEA-ICTP Nuclear Structure and Decay Data Workshop

August 6-17, 2012

XUNDL + other items

1. XUNDL database, including compilation of post AME-2003 mass measurement papers

2. Plan of practical work on A=211

http://www.nndc.bnl.gov

XUNDL: What? When and why? Who?

- eXperimental Unevaluated Nuclear Data List

Compiled (in ENSDF format) Nuclear Structure data from reactions and radioactive decays from current papers in PR-C, PRL, NP-A, EPJ-A, PL-B, JP-G, and several others including some arXiv preprints. In general, information is provided from a single journal article, or from a set of follow-up articles by the same experimental group.

Topics: level schemes from reactions and decays, half-lives, level lifetimes, spins, rotational and quasi-rotational bands, B(E2), moments, nuclear radius, etc.

Started in December 1998 at McMaster University in response to recommendations of an advisory panel for nuclear data program set up by Office of Science, DOE in 1996, that high-spin data in ENSDF database were lagging far behind. Until 2004, compilations were for high-spin papers only. Since then all experimental structure papers are compiled.

XUNDL: What? When and why? Where?

- Bulk (~80%) of the compilations are done at McMaster; compilations received from other centers are reviewed at McMaster.
- Since April 2008, Dr. Filip Kondev at ANL: NP-A, PL-B, JP-G articles
- Since April 2009, Dr. John Kelley at TUNL: A=2-20
- Some other researchers have contributed also in last 2-3 years.

- Most papers compiled within a month or earlier of their appearance on journal web pages. Example: July 2012 papers in PRC, PRL and EPJ-A are already in the database.

XUNDL: Purpose and Scope

- Provides prompt internet access to nuclear structure data in current publications through on-line retrieval system at NNDC, BNL; and through RADWARE level-scheme database at ORNL.
- Complements ENSDF database, where data for some of the nuclides may be several years old and outdated.
- Serves as a repository of relevant data details which for one reason or another do not appear in publications. Dr. Schiffer's group from ANL, for example, sent data tables and other details for four of their papers in PRL/PRC to include only in XUNDL.

XUNDL: Purpose and Scope

- Not limited to regular journal publications only.
- At the request of researchers, unpublished data for completed studies or from preprints can also be included. Papers dealing only with analysis of experimental data can also be included.
- It is called “Unevaluated”, yet each paper goes through a critical compilation with partial evaluation within the context of the paper, and problems identified and resolved. However, no comparisons are made with papers from other labs on the same topic.

XUNDL: Procedures

- Identify articles: scanning of journal web pages on a daily basis.
- Identify data-related problems or lack of detailed data in a paper. If so, consult author(s) for clarification or obtaining data details. Extensive communications with authors have taken place with about 600 of these since 1999. Several errata have appeared as a result of these.
- For large data tables, commercial codes Finereader/Adobe-9 Professional used to scan and create tabular text files from PDF files downloaded from journal web pages.
- TABULAR-TEXT-to-ENSDF conversion code, developed at McMaster used to generate draft ENSDF-formatted data sets.
- Manual editing of draft data sets to add comments and other items. Manual preparation of data sets when no large tables.
- Data sets run through FMTCHK, GTOL, BrIcc (if necessary); and for decay datasets also through LOGFT codes.

XUNDL: Procedures

- Level schemes, bands, and other numerical data in the compiled data sets run through LBNL's ISOTOPE-EXPLORER and/or BNL's PANDORA.
- Finally all data sets checked manually. Sent to NNDC on a weakly basis.
- Database management is at NNDC, BNL.
- Browse database by nuclide, mass number, index. Also by article through NSR database.
- However, no search capabilities as yet.
- Comments from users welcome. Corrections made if necessary.

XUNDL: Procedures

- At McMaster, most draft datasets are prepared by one or two undergraduate (first and second-year Physics) students, working full-time in summer and part-time during semesters. They also get an opportunity to participate in experimental work in nuclear astrophysics with Dr. Alan Chen. Students get training in basic nuclear physics, use of ENSDF, NSR databases; and all the computer codes related to ENSDF work.
- Undergraduate student participation for regular updating of XUNDL database is absolutely necessary.

The XUNDL Process

- Paper Appears

2012Do07

PRL **108,** 262502 (2012) PHYSICAL REVIEW LETTERS week ending 29 JUNE 2012

Key Resonances in the $^{30}P(p, \gamma)^{31}S$ Gateway Reaction for the Production of Heavy Elements in ONe Novae

D. T. Doherty,[1] G. Lotay,[1] P. J. Woods,[1] D. Seweryniak,[2] M. P. Carpenter,[2] C. J. Chiara,[2,3] H. M. David,[1] R. V. F. Janssens,[2] L. Trache,[4] and S. Zhu[2]

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(Received 9 March 2012; published 28 June 2012)

Material emitted as ejecta from ONe novae outbursts is observed to be rich in elements as heavy as Ca. The bottleneck for the synthesis of elements beyond sulphur is the $^{30}P(p, \gamma)^{31}S$ reaction. Its reaction rate is, however, not well determined due to uncertainties in the properties of key resonances in the burning regime. In the present study, gamma-ray transitions are reported for the first time from all key states in ^{31}S relevant for the $^{30}P(p, \gamma)^{31}S$ reaction. The spins and parity of these resonances have been deduced, and energies have been measured with the highest precision to date. The uncertainty in the estimated $^{30}P(p, \gamma)^{31}S$ reaction rate has been drastically reduced. The rate using this new information is typically higher than previous estimates based on earlier experimental data, implying a higher flux of material processed to high-Z elements in novae, but it is in good agreement with predictions using the Hauser-Feshbach approach at higher burning temperatures.

DOI: 10.1103/PhysRevLett.108.262502 PACS numbers: 23.20.Lv, 21.10.Dr, 26.50.+x

The XUNDL Process

- Collect relevant data

TABLE I. Properties of excited states in ^{31}S. Level energies are corrected for the recoil of the compound nucleus. The first column lists the most precise energy measurement of the state from previous work.

E_x (keV) (previous)	E_x (keV) (present)	E_r (keV)	E_γ (keV)	a_2/a_4	R_{DCO}	ΔJ	Assignment
6134(2)[a]	6138.3(21)	7.4(21)	2785.7(20)[c]			0, 2	$(3/2, 7/2)^+ \rightarrow 7/2^+$
			4889.5(6)[c]	0.15(12)/0.03(14)	1.12(24)	0, 2	$(3/2, 7/2)^+ \rightarrow 3/2^+$
6160.2(7)[b]	6158.5(5)	27.6(6)	1707.6(3)	0.22(2)/ − 0.07(3)	1.08(7)	0	$7/2^+ \rightarrow 7/2^-$
			2873.9(6)			1	$7/2^+ \rightarrow 5/2^+$
6259(1)[a]		129.1(10)					$1/2^+$
6283(2)[a]		152.1(21)					$3/2^+; T = 3/2$
6327(2)[a]	6327.0(5)	196.1(6)	5077.7(5)[c]	0.14(7)/0.10(9)	0.90(24)	0	$3/2^- \rightarrow 3/2^+$
6357(2)[a]	6357.3(2)	226.4(5)	5108.0(2)[c]	−0.25(5)/ − 0.01(7)	0.49(11)	1	$5/2^- \rightarrow 3/2^+$
6376.9(5)[b]	6376.9(4)	246.0(6)	1925.7(2)	−0.71(1)/0.03(1)	0.44(2)	1	$9/2^- \rightarrow 7/2^-$
			3025.4(3)	−0.46(1)/ − 0.01(2)	0.58(2)	1	$9/2^- \rightarrow 7/2^+$
	6392.5(2)	261.6(5)	5143.1(2)[c]	−0.25(3)/ − 0.09(3)	0.75(3)	1	$5/2^+ \rightarrow 3/2^+$
6393.7(5)[b]	6394.2(2)	263.3(4)	1091.2(4)	−0.37(5)/ − 0.01(1)	0.47(2)	1	$11/2^+ \rightarrow 9/2^+$
			3042.9(1)	0.26(1)/ − 0.26(1)	1.33(3)	2	$11/2^+ \rightarrow 7/2^+$
6543(2)[a]	6541.9(4)	411.0(6)	5292.5(4)[c]	0.13(4)/ − 0.03(6)	0.94(15)	0	$3/2^- \rightarrow 3/2^+$
6585(2)[a]	6583.1(20)	452.2(21)	3298.0(20)[c]			0, 1	$(5/2, 7/2)^- \rightarrow 5/2^+$
6636.3(15)[b]	6636.1(7)	505.2(8)	2184.9(4)			1	$9/2^- \rightarrow 7/2^-$
			3284.7(2)	−0.48(1)/ − 0.02(2)	0.49(3)	1	$9/2^- \rightarrow 7/2^+$

[a]Ref. [11].
[b]Ref. [14].
[c]Gamma rays observed for the first time in this work.

The XUNDL Process

- Collect relevant data

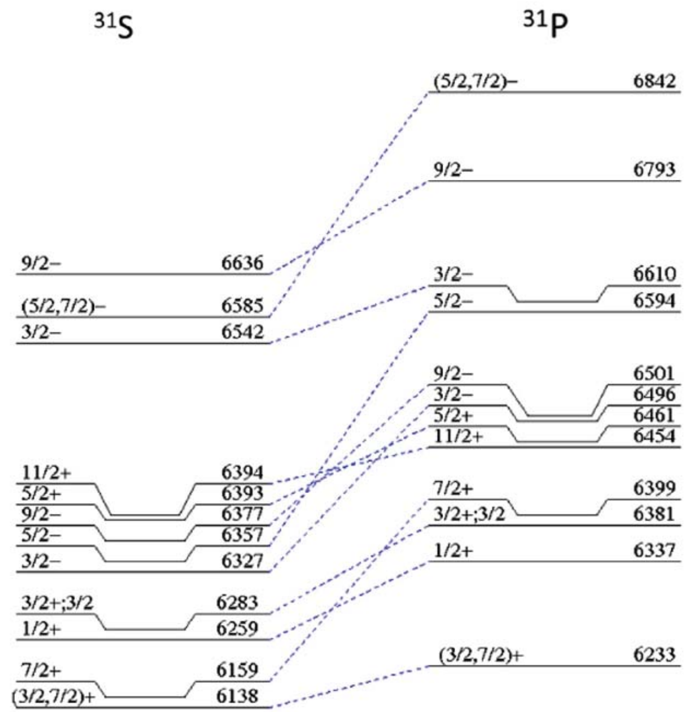


FIG. 2 (color online). Mirror diagram for states within 500 keV of the ^{30}P + p threshold. Excitation energies and J^{π} values in ^{31}S are from the present work with ^{31}P from Refs. [20,21,25].

Mirror Nuclei: ^{31}P: spins and parities are not all correct based on recent evaluation. This is not mentioned in XUNDL dataset but will get discussed in ENSDF evaluation.

The XUNDL Process

- Write in ENSDF format

```
31S     28SI(4HE,NG):XUNDL-11         2012DO07                          201207
31S  c  Compiled (unevaluated) dataset from 2012Do07:
31S 2c  Phys Rev Lett 108, 262502 (2012).
31S  c  Compiled by E. Thiagalingam and B. Singh (McMaster); July 9, 2012
31S  c  Updated by B. Singh, July 18, 2012
31S  c  The experiment was performed using the Argonne ATLAS accelerator.
31S  c  {+4}He beam at E=22 MeV. Target=120 |mg/cm{+2} {+28}Si. Gamma rays
31S 2c  detected by a Gammasphere array. Measured E|g, I|g, |g|g-coin, |g(|q),
31S 3c  DCO ratios. Deduced levels, J, |p, reaction rates for
31S 4c  {+30}P(p,|g){+31}S of astrophysical interest
31S  c  Comparison of level energies, spins and parities with those in
31S 2c  mirror nucleus {+31}P
31S   L 0.0          1/2+
31S  cL J$ from Adopted dataset for {+31}S in ENSDF database.
31S   L 1248.8       3/2+
31S   L 2235.6
31S   L 3284.6       5/2+
31S   L 3352.9        7/2+
31S   L 4451.0        7/2-
31S   L 5304.7        9/2+
31S   L 6138.3    21 (3/2,7/2)+
31S  cL $Ep{-res}=7.4 {I21}
31S   G 2785.7    20
31S   G 4889.5    6
31S 2 G DCO=1.12 24 $ A2=+0.15 12 $ A4=+0.03 14
31S   L 6158.5    5  7/2+
31S  cL $Ep{-res}=27.6 {I6}
31S   G 1707.6    3
31S 2 G DCO=1.08 7 $ A2=+0.22 2 $ A4=-0.07 3
31S   G 2873.9    6
31S   L 6327.0    5  3/2-
31S  cL $Ep{-res}=196.1 {I6}
31S   G 5077.7    5
31S 2 G DCO=0.90 24 $ A2=+0.14 7 $ A4=+0.10 9
```

The XUNDL Process

- Display in HTML/NDS format

28SI(4HE,NG):XUNDL-11 2012Do07

Compiled (unevaluated) dataset from 2012Do07: Phys Rev Lett 108, 262502 (2012).
Compiled by E. Thiagalingam and B. Singh (McMaster); July 9, 2012.
Updated by B. Singh, July 18, 2012.
The experiment was performed using the Argonne ATLAS accelerator.
^{4}He beam at E=22 MeV. Target=120 μg/cm^{2} ^{28}Si. Gamma rays detected by a Gammasphere array. Measured Eγ, Iγ, γγ-coin, γ(θ), DCO ratios. Deduced levels, J, π, reaction rates for ^{30}P(p,γ)^{31}S of astrophysical interest.
Comparison of level energies, spins and parities with those in mirror nucleus ^{31}P.

^{31}S Levels

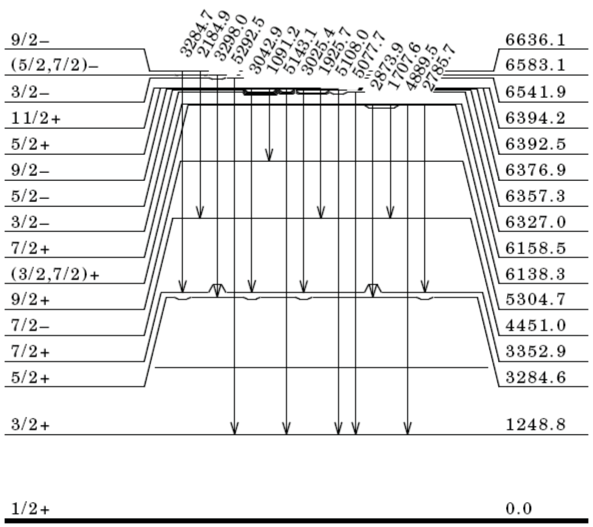
E(level)	Jπ	Comments
0.0	1/2+	Jπ: from Adopted dataset for ^{31}S in ENSDF database.
1248.8	3/2+	
2235.6		
3284.6	5/2+	
3352.9	7/2+	
4451.0	7/2−	
5304.7	9/2+	
6138.3 *21*	(3/2,7/2)+	Ep_{res}=7.4 *21*.
6158.5 *5*	7/2+	Ep_{res}=27.6 *6*.
6327.0 *5*	3/2−	Ep_{res}=196.1 *6*.
6357.3 *2*	5/2−	Ep_{res}=226.4 *5*.
6376.9 *4*	9/2−	Ep_{res}=246.0 *6*.
6392.5 *2*	5/2+	Ep_{res}=261.6 *5*.
6394.2 *2*	11/2+	Ep_{res}=263.3 *4*.
6541.9 *4*	3/2−	Ep_{res}=411.0 *6*.
6583.1 *20*	(5/2,7/2)−	Ep_{res}=452.2 *21*.
6636.1 *7*	9/2−	Ep_{res}=505.2 *8*.

γ(^{31}S)

Eγ	E(level)	Comments
1091.2 *4*	6394.2	DCO=0.47 *2*; A_2=−0.37 *5*; A_4=−0.01 *1*.
1707.6 *3*	6158.5	DCO=1.08 *7*; A_2=+0.22 *2*; A_4=−0.07 *3*.
1925.7 *2*	6376.9	DCO=0.44 *2*; A_2=−0.71 *1*; A_4=+0.03 *1*.
2184.9 *4*	6636.1	
2785.7 *20*	6138.3	
2873.9 *6*	6158.5	
3025.4 *3*	6376.9	DCO=0.58 *2*; A_2=−0.46 *1*; A_4=−0.01 *2*.
3042.9 *1*	6394.2	DCO=1.33 *3*; A_2=+0.26 *1*; A_4=−0.26 *1*.
3284.7 *2*	6636.1	DCO=0.49 *3*; A_2=−0.48 *1*; A_4=−0.02 *2*.
3298.0 *20*	6583.1	
4889.5 *6*	6138.3	DCO=1.12 *24*; A_2=+0.15 *12*; A_4=+0.03 *14*.
5077.7 *5*	6327.0	DCO=0.90 *24*; A_2=+0.14 *7*; A_4=+0.10 *9*.
5108.0 *2*	6357.3	DCO=0.49 *11*; A_2=−0.25 *5*; A_4=−0.01 *7*.
5143.1 *2*	6392.5	DCO=0.75 *3*; A_2=−0.25 *3*; A_4=−0.09 *3*.
5292.5 *4*	6541.9	DCO=0.94 *15*; A_2=+0.13 *4*; A_4=−0.03 *6*.

28SI(4HE,NG):XUNDL-11 2012Do07 (continued)

Level Scheme



$^{31}_{16}S_{15}$

The XUNDL Process

- Another Recent Paper

2012De11

PHYSICAL REVIEW C **86**, 014326 (2012)

In-beam spectroscopy of $^{215}Rn_{86}$

M. E. Debray,[1,2] M. Davidson,[3] J. Davidson,[3] A. J. Kreiner,[1,2,3] M. A. Cardona,[1,2,3] D. Hojman,[1,3] D. R. Napoli,[4] S. Lenzi,[5] G. de Angelis,[4] M. De Poli,[4] A. Gadea,[4] D. Bazzacco,[5] C. Rossi-Alvarez,[5] N. Medina,[6] and C. A. Ur[5]

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[5]*Dipartimento di Fisica, Sezione di Padova, Padova, Italy*
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(Received 29 July 2011; revised manuscript received 4 May 2012; published 20 July 2012)

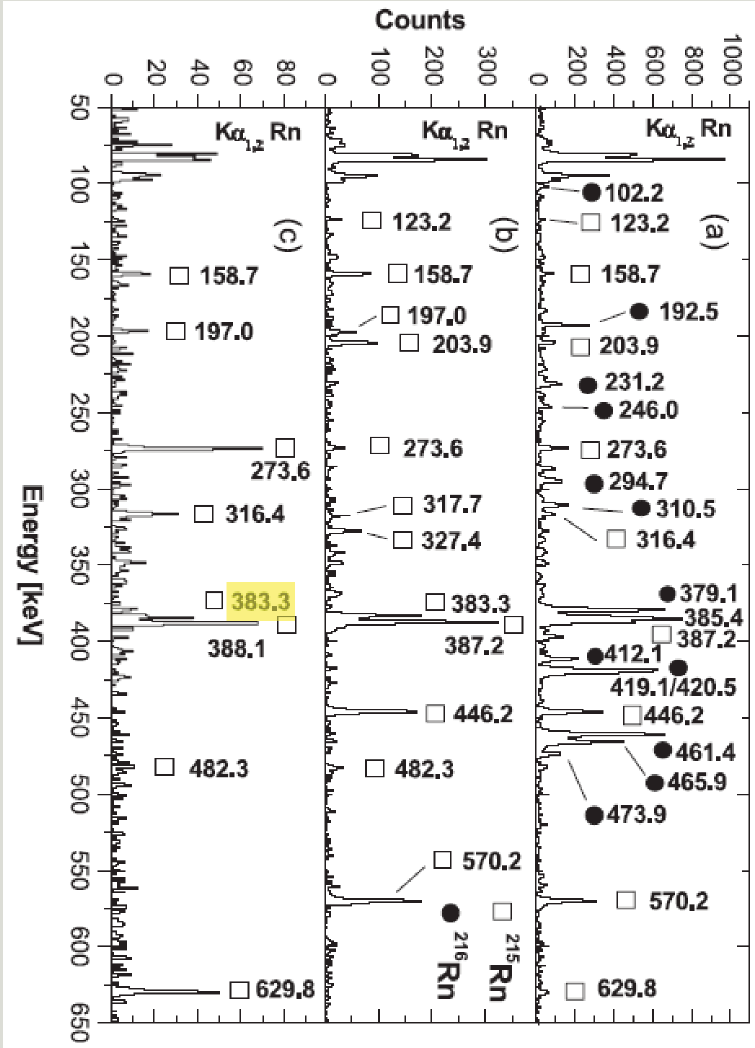
The yrast level structure of ^{215}Rn has been studied by means of in-beam spectroscopy α-γ-γ coincidence techniques through the ^{207}Pb(^{18}O,$2\alpha 2n$) reaction at 93 MeV bombarding energy, using the 8π GASP-ISIS spectrometer at Legnaro. New spectroscopic information has been obtained. The deduced low-lying level scheme of ^{215}Rn does not exhibit the alternating parity structure observed in the heavier known isotones ^{216}Fr, ^{217}Ra, ^{218}Ac, and ^{219}Th. From this result, the lightest nucleus showing evidence for octupole collectivity is ^{216}Fr, defining the lowest-mass corner for this kind of phenomenon as $N \geqslant 129$ and $Z \geqslant 87$.

DOI: 10.1103/PhysRevC.86.014326 PACS number(s): 21.10.Re, 23.20.Lv, 25.70.Gh, 27.80.+w

The XUNDL Process

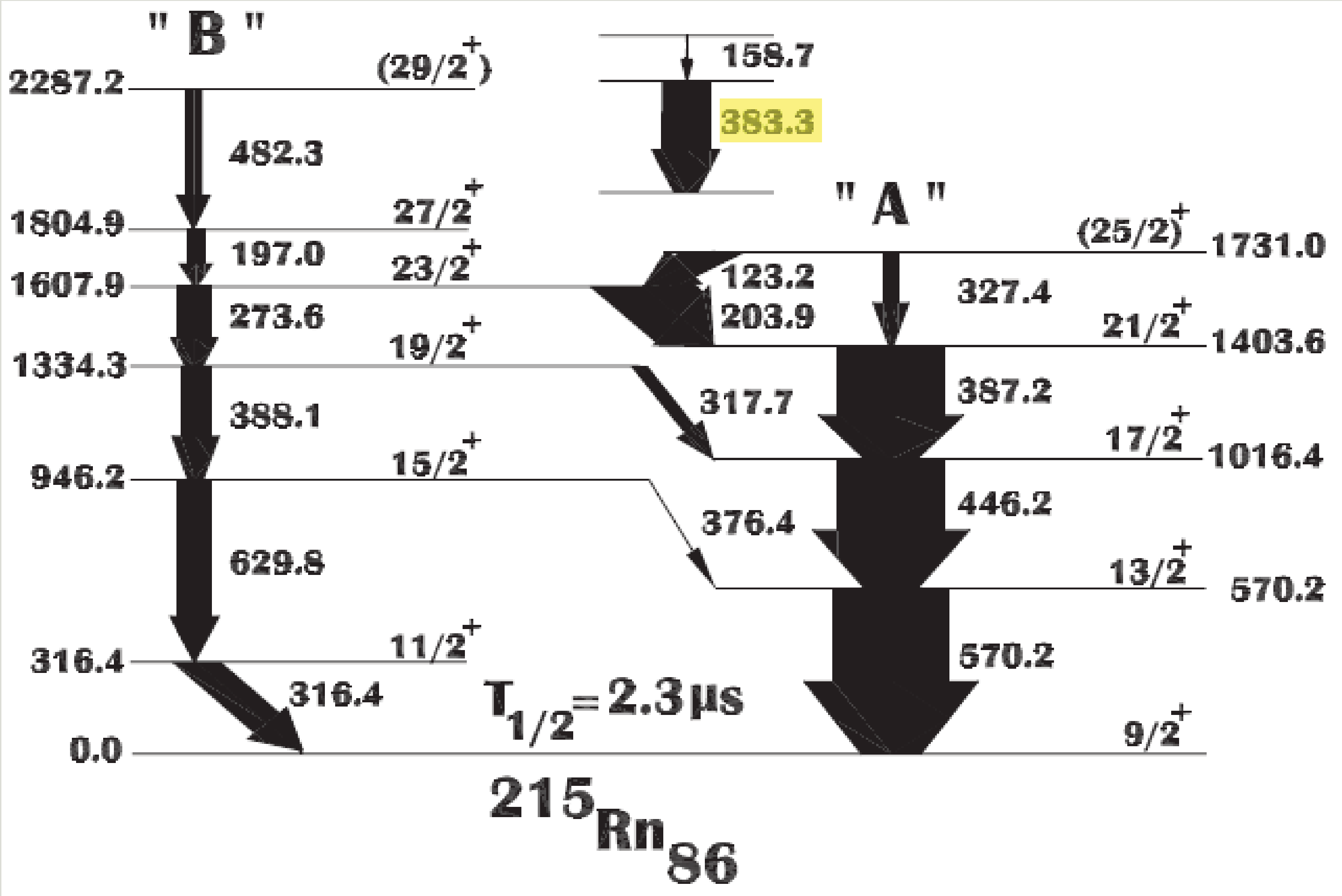
- Collect relevant data

E_γ[a] (keV)	I_γ	R	I^{Tot}	Adopt. mult.
123.2	5(1)		42(9)	$(M1)$[b]
158.7	22(6)	1.1(5)		
197.0	9(2)	0.9(0.26)	14(3)	$E2$
203.9	27(6)	0.5(2)	74(16)	$M1$
215.6[c]	4.3(9)			
230.9[c]	4.1(9)			
273.6	24(5)	0.92(0.25)	28(6)	$E2$
316.4	25(3)	0.7(2)	37(5)	$M1$[d]
317.7[e]	10(2)		15(5)	$M1/E2$
327.4	10(2)		12(2)	$(E2)$[f]
376.4	< 2			
383.5	42(8)	0.6(2)	45(9)	
387.2	78(14)	0.9(2)	82(15)	$E2$
388.1[e]	25(7)		26(8)	$(E2)$
446.2	86(6)	0.85(0.15)	88(7)	$E2$
482.3	13(1)		13(1)	$(M1/E2)$[f]
570.2	100(5)	1.0(0.15)	100(5)	$E2$
572.5[c]	5(2)			
629.8	26(3)	0.9(3)	26(3)	$E2$



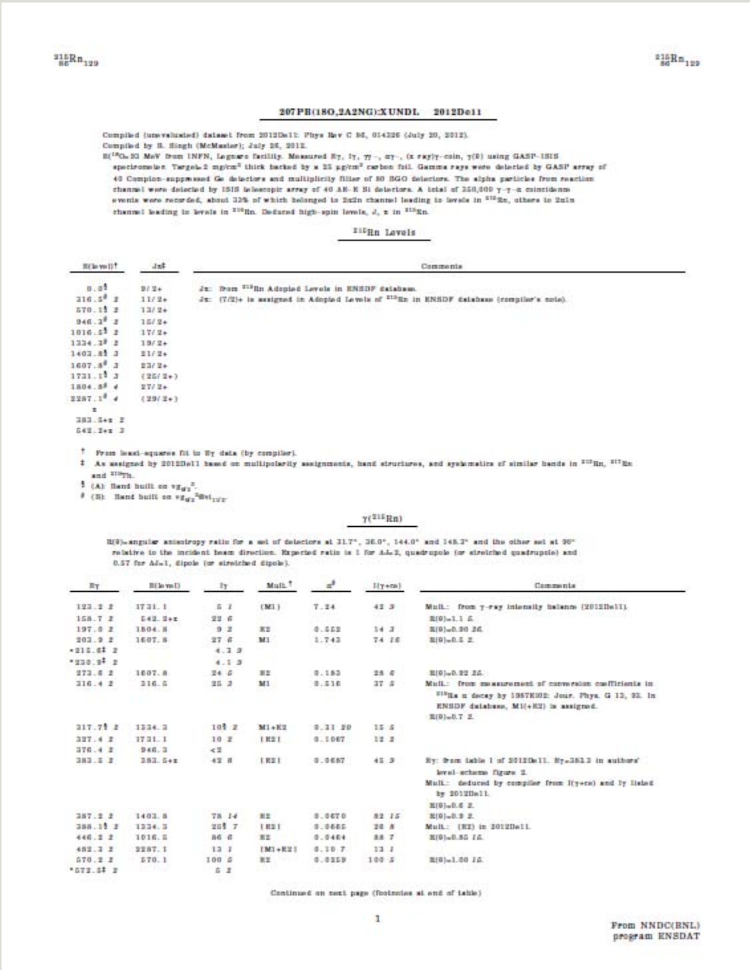
The XUNDL Process

- Collect relevant data



The XUNDL Process

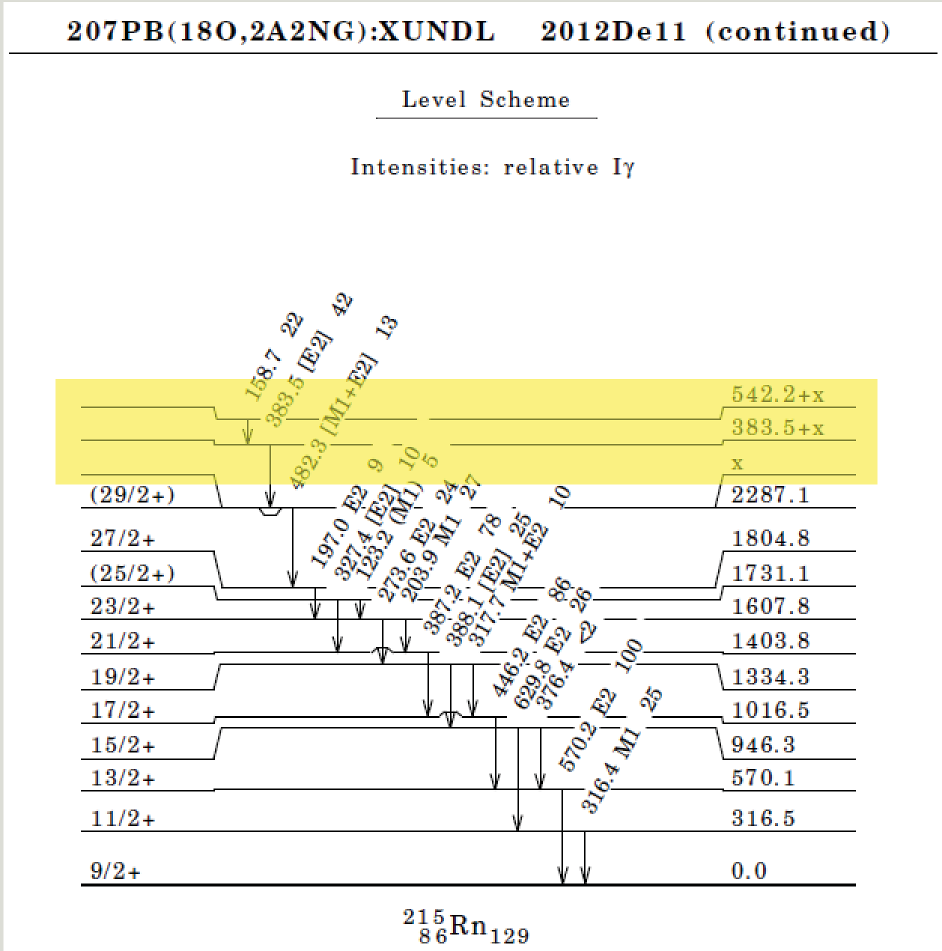
- Display in HTML/NDS format



207PB(18O,2A2NG):XUNDL 2012De11

^{215}Rn Levels

γ(^{215}Rn)



The XUNDL Process

PHYSICAL REVIEW C **86**, 014328 (2012)

Competing single-particle and collective behavior in ^{71}Se

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J. K. Bruckman,[5] and C. R. Hoffman[4,†]
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(Received 16 December 2011; revised manuscript received 29 June 2012; published 30 July 2012)

The high-spin decay of ^{71}Se was studied using the ^{54}Fe(^{23}Na,αpn) reaction at 80 MeV and the Florida State University Compton-suppressed Ge array consisting of three clover detectors and seven single-crystal detectors. Based on prompt γ-γ coincidences measured in the experiment, the known level scheme was enhanced and extended to higher spin with 19 new transitions. A band that was previously suggested to have positive parity was reassigned as the "missing" signature partner of an existing negative-parity band. Spins were assigned based on directional correlation of oriented nuclei ratios. Lifetimes of 17 excited states were measured using the Doppler-shift attenuation method. Experimental Q_t values imply an intermediate degree of collective behavior for ^{71}Se at high spin. Theoretical Q_t values determined from cranked Woods-Saxon (CWS) calculations show better agreement with the experimental ones for the positive-parity states than the negative-parity states. Shape competition and γ softness characterize the low-spin states of the lowest positive- and negative-parity bands based on the CWS calculations. At high spin, triaxial shapes with $\gamma > 0^\circ$ are predicted.

The XUNDL Process: calculational errors

(Reply received from authors August 1: matter resolved)

COMPETING SINGLE-PARTICLE AND COLLECTIVE . . . PHYSICAL REVIEW C **86**, 014328 (2012)

TABLE II. Initial-state spins, γ-ray transition energies, mean lifetimes, electric quadrupole transition strengths $B(E2)$, and transition quadrupole moments $|Q_t|$ in ^{71}Se measured in this work. Individual mean lifetimes deduced from a DSAM analysis of line shapes measured at the indicated angles from transitions with energy E_γ are given in the same row. The accepted mean lifetimes (τ_{acc}) represent the weighted average (based on the uncertainties) of the measurements at 35° and 145° where results are available.

I_i^π	E_γ (keV)	τ_{prev}[a] (ps)	$\tau_{35°}$[b] (ps)	$\tau_{145°}$[b] (ps)	τ_{acc} (ps)	$B(E2)$ (W.u.)[c]	$\lvert Q_t\rvert$ (e b)
				Band 1			
$(\frac{15}{2}^+)$	1263.3			0.39^{+11}_{-10}	0.39^{+11}_{-10}	37^{+13}_{-8}	1.63^{+26}_{-19}
$(\frac{19}{2}^+)$	1033.6			0.43^{+12}_{-9}	0.43^{+12}_{-9}	66^{+17}_{-14}	2.01^{+25}_{-23}
$(\frac{23}{2}^+)$	1045.7		<1.15[d]		<1.15[d]	>20	>1.07
				Band 2			
$\frac{13}{2}^+$	1037.3	1.30(40)	>2[e]	>2[e]	>2[e]	<19	<1.25
$\frac{17}{2}^+$	1150.5	0.77(30)	0.77^{+6}_{-5}[e]		0.77^{+6}_{-5}[e]	30(2)	1.40(5)
$\frac{21}{2}^+$	1186.9	0.58(40)	0.44(3)[e]	0.36^{+4}_{-3}[e]	0.41(2)[e]	48(2)	1.69(4)
$(\frac{25}{2}^+)$	1199.2		0.56(5)	0.35(6)	0.47(4)	38^{+4}_{-3}	1.46^{+7}_{-6}
$(\frac{29}{2}^+)$	1202.0		0.57(5)	0.52(5)	0.54(4)	34^{+3}_{-2}	1.36(5)
$(\frac{33}{2}^+)$	1339.2		<0.13[d]		<0.13[d]	>84	>2.09
				Band 3			
$\frac{15}{2}^-$	800.9	0.76(40)	>2[e]	>2[e]	>2[e]	<71	<2.24
$\frac{19}{2}^-$	945.5	<1	1.45^{+8}_{-7}	0.81^{+3}_{-4}	0.92(3)	67(2)	2.03(3)
$\frac{23}{2}^-$	1077.7		0.56^{+3}_{-2}	0.42(2)	0.48(2)	67(3)	1.95(4)
$(\frac{27}{2}^-)$	1140.7		0.78^{+8}_{-6}	0.42(6)	0.57(5)	42^{+4}_{-3}	1.52^{+7}_{-6}
$(\frac{31}{2}^-)$	1302.0		<0.33[d]	<0.14[d]	<0.24[d]	>52	>1.66
				Band 4			
$\frac{17}{2}^-$	909.6		1.88^{+31}_{-24}	1.05^{+13}_{-11}	1.18(11)	64^{+7}_{-5}	2.04^{+10}_{-9}
$(\frac{21}{2}^-)$	1063.6		0.75(3)	0.62^{+4}_{-3}	0.70(2)	49(1)	1.70(2)
$(\frac{25}{2}^-)$	1200.9			<0.24[d]	<0.24[d]	>78	>2.08

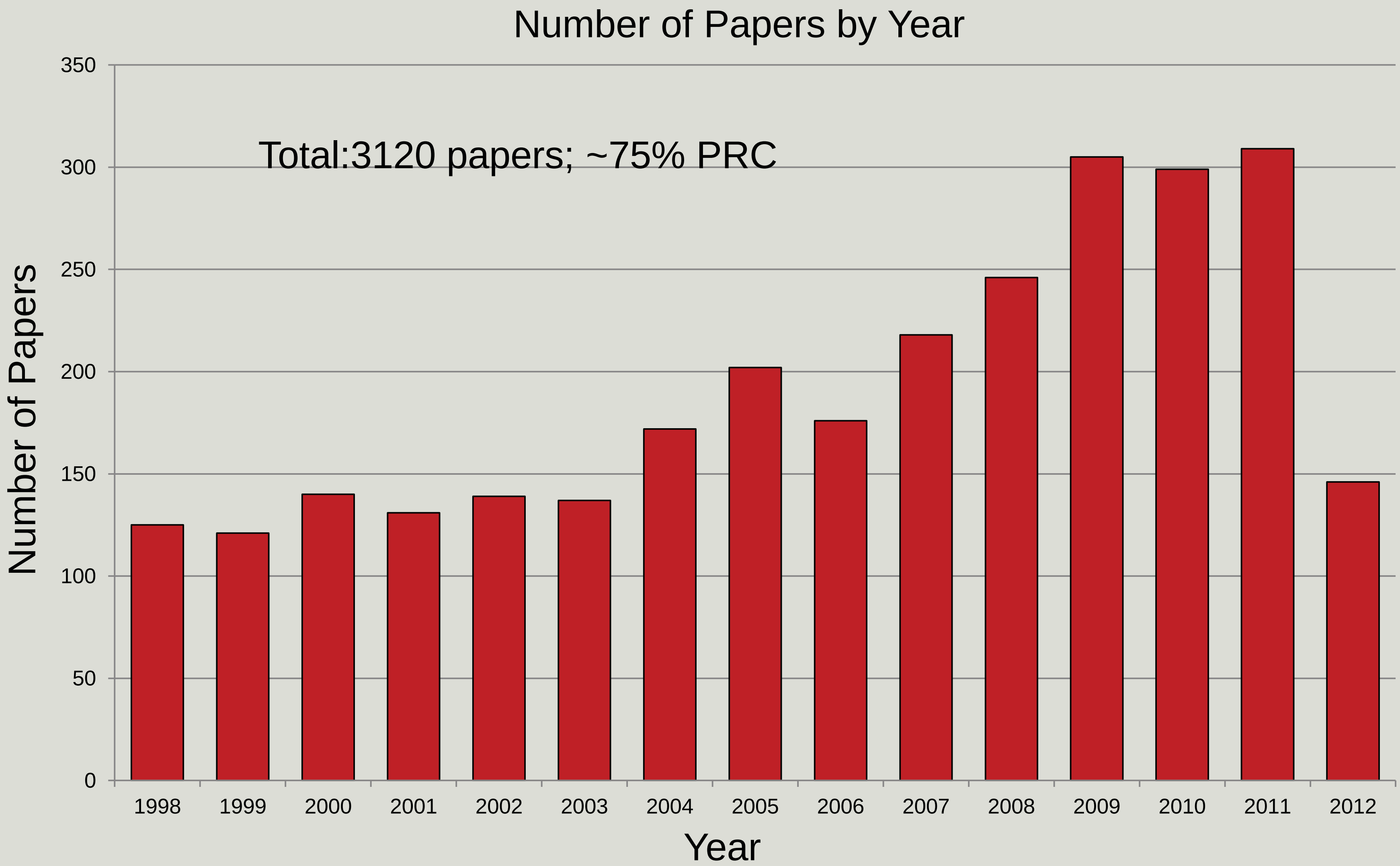
[a]From Ref. [20].
[b]Determined from spectra gated from below (GFB) the listed transition, unless otherwise noted.
[c]1 W.u. = 17.46 e^2 fm^4.
[d]Effective lifetime.
[e]Determined from spectra gated from above (GFA) the listed transition.

corrected

$\boxed{18\ {+7}{-8} \quad 44\ {+22}{-23}}$

$\boxed{\pm 14,\ \text{not } {+4}{-3}}$

Number of Papers by Year



Current contents of XUNDL

- 4897 compiled datasets
- 2129 nuclides: A=1-294 spread over 288 isobaric chains. (only A=2, 3, 4, 223, 275, 292 not represented)
- Data extracted from 3120 publications, mostly from 1995-2012 in primary nuclear physics journals .
- About 550 communications with original authors of papers to resolve data inconsistencies or errors, and to obtain additional details of data for completeness and archival purpose.
- This part of the activity is considered as most useful as it is timely and of interest to researchers and ENSDF evaluators.

Mass Compilations

- Penning-trap systems and Radioactive-ion beam facilities have pushed the field of precise mass measurements very fast. Just in 2008-2012, about 90 primary publications in PRL/PRC have appeared for masses of about 500 nuclides, many of these far-off the stability line in chart of nuclides.
- ENSDF format unsuitable for mass papers.
- Since AME-2003 (NP-A 729, 337), ~ 120 papers have been compiled, with data for about 600 nuclides.
- Compiled data are available on ORNL web page: www.nuclearmasses.org.
- There have been several requests from researchers for these compiled data.

A=211: Practical Work-plan

(Aug 8-9, 13-16 afternoon sessions)

- Why A=211?
- **Practical reasons**:

-Current data in ENSDF ~10 years old: Jan 1, 2003.

-Short mass chain i.e. not a huge amount of total data.

-Mixture of different types of decays and reactions.

-Although, there are perhaps only 12 new papers for A=211, still each mass chain in ENSDF needs to be updated after 10 years.

-Update of new Q values from 2011/2012-AME from previous 2003 values

-Update of internal conversion coefficients using BrIcc code, replacing previous values from Hager-Seltzer coefficients.

A=211: Practical Work-plan

(Aug 8-9, 13-16 afternoon sessions)

- **Nuclear Physics reasons**:

  - Experimentally known Nuclides of A=211 (Z=80-91, N=131-120) are semi-magic or few particles away from Z=82, N=126 doubly-magic Pb-208 nuclide.

  - Single- or multi-particle structures are expected

  - Significant number of isomers have been identified.

  - Comparisons with shell-model calculations are possible

- **Medical physics reasons**:

  At-211 (7.2 h) + Po-211 (0.5 s): used for targeted alpha-particle radiotherapy. Easily produced in a cyclotron using Bi(α,2n) reaction. Radiopharmaceutical compounds used to treat carcinomas (M. Welch, Jour. Nucl. Med. 46, 1254 (2005)); also brain tumors. At-211 labeled monoclonal antibodies.

- **Environmental aspects**: Bi-211 (2.1 min), Po-211 (0.5 s), Pb-211 (36 min); and At-215 (0.1 ms), Po-215 (1.8 ms), Tl-207 (4.8 min) present in environment from U-235 decay

A=211: Practical Work-plan

(Aug 8-9, 13-16 afternoon sessions)

- **Experimentally known nuclides of A=211**

Hg-211: Z=80, N=131: only isotope ID; no $T_{1/2}$

Tl-211: Z=81, N=130: Isotope ID; $T_{1/2}$ just came in PL-B acc. paper Aug 3, 2012

Pb-211: Z=82, N=129: α decay; (t,d); in-beam γ-ray

Bi-211: Z=83, N=128: α, β- decays; (α,p); (d,p); (t,p); in-beam γ-ray

Po-211: Z=84, N=127: α, β-, ε decays; (d,p); in-beam γ-ray

At-211: Z=85, N=126: α, ε decays; in-beam γ-ray

Rn-211: Z=86, N=125: α, ε+β+ decays; in-beam γ-ray

Fr-211: Z=87, N=124: α decay; in-beam γ-ray

Ra-211: Z=88, N=123: α decay

Ac-211: Z=89, N=122: α decay

Th-211: Z=90, N=121: only isotope ID and $T_{1/2}$ known

Pa-211: Z=91, N=120: (uncertain isotope ID, no $T_{1/2}$)

α-decay parents: A=215 nuclides. α-decay daughters: A=207 nuclides

A=211: Practical Work-plan

(Aug 8-9, 13-16 afternoon sessions)

Nuclide assignments:

1. **Alejandro Sonzogni + Gopal Mukherjee (Aug 13-16):** **Pb-211, Fr-211**
   Moinul Haque Meaze
   Ariel Tarazaga
   Frank Bello Garrote
   Jia Wang
2. **Daniel Abriola:** **Ac-211, Ra-211**
   Jasmeet Kaur
   Hanxiong Huang
   Pavel Blokhin
   Maryam Hassanvand
3. **Jagdish Tuli :** **Po-211**
   Jeong-Yeon Lee
   Neha Sharma
   Mazhar Hussain
   Mohamed Eisa

A=211: Practical Work-plan

(Aug 8-9, 13-16 afternoon sessions)

Nuclide assignments:

4. **Tim Johnson:** Rn-211
   Yong-Jing Chen
   Sansarbayer Enkhbold
   Gehan Khalil
   Bo Yang
5. **Elizabeth McCutchan (Aug 8,9) + Coral Baglin (Aug 13-16):** Bi-211
   Oleksandr Gorbachenko
   Zehua Hu
   Natasa Todorovic
   Mahmoud Taha
6. **Balraj Singh:** At-211
   Sukhjeet Dhindsa
   Ali Abdul Alzubedi
   Hai Xuan Nguyen
   Monika Patial

A=211: Practical Work-plan

(Aug 8-9, 13-16 afternoon sessions)

- All work may not get completed by Aug 16. Some will be required in the next few weeks.
- Expected completion of first draft by the end of Oct 2012
- Send data files to B. Singh, co-ordinator for this evaluation.
- Final files by end of Nov 2012; send for review.
- Possible joint publication in NDS by Feb 2013 under the authorship of lecturers, and those participants who contribute effectively to the evaluation effort.

A=211: Practical Work-plan
(Aug 8-9, 13-16 afternoon sessions)

- Reference material on CD:

  All previously published evaluations of A=211

  A=211, 215 in Table of isotopes-1978

  A=211, 215 DDEP evaluations of selected isotopes.

  2011AuZZ: AME interim mass adjustment files

  2011StZZ: compilation of static magnetic dipole and electric quadrupole moments

  2004An04: evaluated nuclear radii.

  Requires familiarity with retrievals of information from ENSDF, XUNDL, NSR, NUDAT databases; and use of computer codes such as FMTCHK, GTOL, BrIcc, LOGFT, ALPHAD, PANDORA, ENSDAT, etc.