



Current status of $\beta\beta$ -decay and $B(E2)$ nuclear data projects

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Project Motivation

- ❑ Up-to-date $\beta\beta$ -decay and $B(E2)$ evaluation and compilation
- ❑ Web Access & Dissemination
- ❑ ENSDF evaluators & physicists need this information
- ❑ Utilization of my expertise in these subjects

Current Status

- B(E2) (<http://www.nndc.bnl.gov>) launched
- $\beta\beta$ -decay was launched

Search the NNDC:

NNDC Site Index
B(E2; 0⁺ → 2⁺) Values
Adopted Values
Experimental Values
Predicted Values
Help

Reduced Transition Probabilities or B(E2; 0⁺ → 2⁺) Values

Adopted Values Experimental Values Predicted Values

Search the NNDC:

NNDC Site Index
ββ-decay
List of Adopted Values
Adopted Values
Experimental Values
ββ Transitions
Help
Resources
2003 Atomic Mass Evaluation
Logft
Nuclear Science References
Nuclear Wallet Cards
Q-value Calculator

ββ-Decay Data

Adopted Values Experimental Values ββ Transitions

Adopted (Recommended) values are based on experimentally observed ββ-decay transitions in ⁴⁸Ca, ⁷⁶Ge, ⁸²Se, ⁹⁶Zr, ¹⁰⁰Mo, ¹¹⁶Cd, ^{128,130}Te, ¹³⁰Ba, ¹⁵⁰Nd and ²³⁸U. Limitation of relative statistical weight program was used to produce complete list of adopted ββ-decay values.

Nucleus
76Ge, ge-76, 32-ge-76, 32076

Process
2K, Kb+, 2e, eb+, b+b+, b-b-

A
76, 82, ...

N
44, 48, ...

Z
32, 34, ...

B(E2) Nuclear Data Project I

- ❑ Over 2,100 nuclear data retrievals during the first year
- ❑ Adopted values - 72.6%
- ❑ Experimental values - 21.6%
- ❑ Theoretical values - 5.8%

B(E2) Nuclear Data Project II

- Project i
- Databas
- Nuclear p
units were
and ps

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Search the NNDC: go

[NNDC Site Index](#)
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[Adopted Values](#)
[Experimental Values](#)
[Predicted Values](#)
[Help](#)
[Editing](#)
[Add New](#)

Reduced Transition Probabilities or B(E2; 0⁺ → 2⁺) Values

[Adopted Values](#) | [Experimental Values](#) | [Predicted Values](#)

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Search the NNDC: go

| # | Nuclide | B(E2; 0 ⁺ → 2 ⁺) | | τ (ps) | Reference |
|----|---------|---|-------------|----------|---|
| | | (e ² b ²) | (W.U.) | | |
| 1 | 18Ne | 0.0180(26) | 64.24(928) | 0.95(14) | RIKEN Accelerator Progress Report 2005, p.55 (2006) |
| 2 | 26Ne | 0.0230(30) | 50.27(656) | 0.53(6) | RIKEN Accelerator Progress Report 2005, p.56 (2006) |
| 3 | 26Ne | 0.0087(13) | 19.02(284) | 1.4(2) | RIKEN Accelerator Progress Report 2005, p.56 (2006) |
| 4 | 20Mg | 0.0229(82) | 71.02(2543) | 1.65(65) | RIKEN Accelerator Progress Report 2005, p.59 (2006) |
| 5 | 32S | 0.0298(6) | 49.38(99) | 0.25(1) | Phys.Lett. B 632, 207 (2006) |
| 6 | 40Ar | 0.0378(14) | 46.52(172) | 1.62(6) | Phys.Lett. B 632, 207 (2006) |
| 7 | 36Ar | 0.0211(6) | 29.88(85) | 0.65(2) | Phys.Lett. B 632, 207 (2006) |
| 8 | 38Ar | 0.0122(3) | 16.08(4) | 0.70(2) | Phys.Lett. B 632, 207 (2006) |
| 9 | 52Ti | 0.0615(60) | 53.35(52) | 5.2(6) | Phys.Lett. B 633, 219 (2006) |
| 10 | 70Ni | 0.0860(140) | 50.19(817) | 1.50(25) | Phys.Rev.Lett. 96, 232501 (2006) |
| 11 | 66Zn | 0.1347(54) | 85.03(341) | 2.5(1) | Phys.Rev. C 73, 064305 (2006) |
| 12 | 74Zn | 0.2040(150) | 110.55(813) | 24.5(18) | Phys.Rev.Lett. 96, 232501 (2006) |

$\beta\beta$ -decay Data Project I

- ❑ Small scale (13 adopted & over 300 best experimental results)
- ❑ Typical $\beta\beta$ -decay measurement is 2-3 years
- ❑ Reliable source of data for ENSDF
- ❑ Particle physics implications: use half-life to produce limit on neutrino mass

$\beta\beta$ -decay Data Project II

- ❑ NSR-based product, DB is 95% complete
- ❑ Lweight was used to produce adopted values
- ❑ $\beta\beta$ -decay transitions (AMDC+NWC) allow to expand the scope of from even-even to all known nuclei
- ❑ Database updates 3-4 times a year

$\beta\beta$ -decay Data Project III

Collaboration
INR, Kiev

The screenshot shows the National Nuclear Data Center (NNDC) website interface. The top navigation bar includes the NNDC logo, the text "National Nuclear Data Center", and the Brookhaven National Laboratory logo. Below the navigation bar, there are links to various databases: NuDat, NSR, XUNDL, ENSDF, MIRDB, ENDF, CSISRS, and CINDA. A search bar is present with the text "Search the NNDC:" and a "go" button. A sidebar on the left contains a menu with items: NNDC Site Index, $\beta\beta$ -decay (highlighted), List of Adopted Values, Adopted Values, Experimental Values, $\beta\beta$ Transitions, Help, Resources, 2003 Atomic Logft, Nuclear Science, Nuclear Wall, and Q-value Calc.

The main content area is titled " $\beta\beta$ -Decay Data" and features three tabs: "Adopted Values" (selected), "Experimental Values", and "BB Transitions". Below the tabs, a note states: "Adopted (Recommended) values are based on experimentally observed $\beta\beta$ -decay transitions in ^{48}Ca ".

The second screenshot shows the "List of Adopted $\beta\beta$ -Decay Values" page. It includes a note: "Limitation of relative statistical weight program was used to produce adopted values." Below this is a table with 13 rows of data.

| # | Nuclide | Process | Transition | $T_{1/2}^{2\nu}(\text{y})$ | $T_{1/2}^{0\nu}(\text{y})$ | $T_{1/2}^{0\nu+2\nu}(\text{y})$ |
|----|-------------------|------------------|-------------------------|--------------------------------|----------------------------|---------------------------------|
| 1 | ^{48}Ca | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | $(4.3 \pm 2.3) \times 10^{19}$ | | |
| 2 | ^{76}Ge | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | $(1.3 \pm 0.4) \times 10^{21}$ | | |
| 3 | ^{82}Se | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | $(9.2 \pm 0.8) \times 10^{19}$ | | |
| 4 | ^{96}Zr | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | $(2.0 \pm 0.4) \times 10^{19}$ | | |
| 5 | ^{100}Mo | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | $(7.0 \pm 0.4) \times 10^{18}$ | | |
| 6 | ^{100}Mo | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+_1$ | | | $(6.1 \pm 0.2) \times 10^{20}$ |
| 7 | ^{116}Cd | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | $(3.0 \pm 0.3) \times 10^{19}$ | | |
| 9 | ^{128}Te | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | | | $(3.5 \pm 2.0) \times 10^{24}$ |
| 8 | ^{130}Te | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | $(6.1 \pm 4.8) \times 10^{20}$ | | |
| 10 | ^{130}Ba | $2e$ | $0^+ \rightarrow 0^+$ | | | $(2.2 \pm 0.5) \times 10^{21}$ |
| 11 | ^{150}Nd | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | $(7.9 \pm 0.7) \times 10^{18}$ | | |
| 12 | ^{150}Nd | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+_1$ | | | $(1.4 \pm 0.5) \times 10^{20}$ |
| 13 | ^{238}U | $\beta^-\beta^-$ | $0^+ \rightarrow 0^+$ | | | $(2.0 \pm 0.6) \times 10^{21}$ |

Conclusion & Outlook

- ❑ Diversification of NNDC products offering with horizontal evaluations
- ❑ Proactive response to research & ENSDF communities needs
- ❑ Integration of B(E2) & $\beta\beta$ -decay data Web applications with NSR, AMDC and NWC
- ❑ 2008-2009: Produce B(E2) & $\beta\beta$ -decay evaluations for publication