# TUNL Contributions in the NSDD

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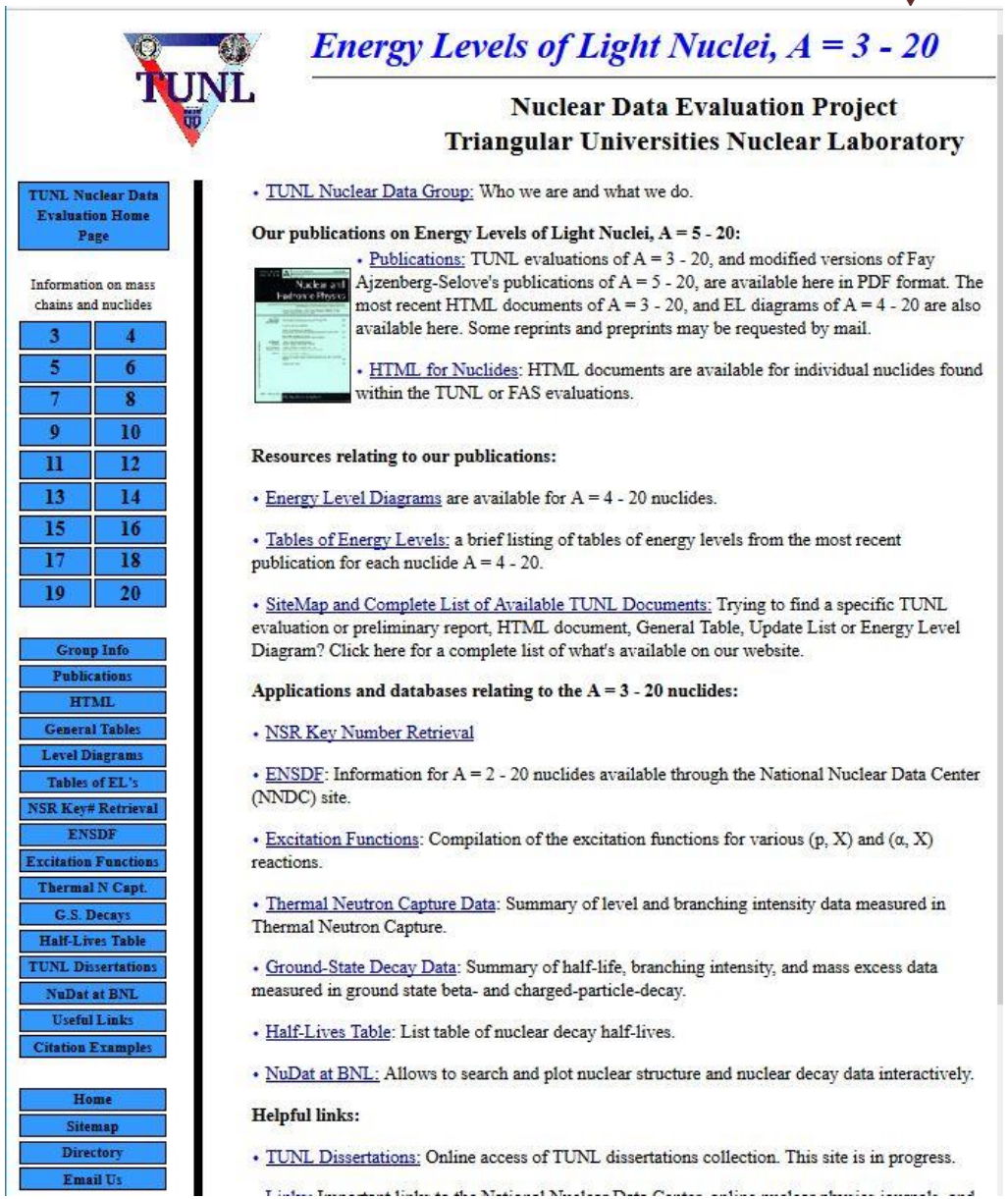
# TUNL Primary Responsibilities

We are responsible for nuclear structure evaluation in the A=2-20 mass region

- ENSDF files for A=2-20
- XUNDL from A=2-20

Web interface for A=3-20 Information



## Energy Levels of Light Nuclei, A = 3 - 20

**Nuclear Data Evaluation Project**
**Triangular Universities Nuclear Laboratory**

TUNL Nuclear Data Evaluation Home Page

Information on mass chains and nuclides

| | |
|---|---|
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |
| 11 | 12 |
| 13 | 14 |
| 15 | 16 |
| 17 | 18 |
| 19 | 20 |

Group Info
Publications
HTML
General Tables
Level Diagrams
Tables of EL's
NSR Key# Retrieval
ENSDF
Excitation Functions
Thermal N Capt.
G.S. Decays
Half-Lives Table
TUNL Dissertations
NuDat at BNL
Useful Links
Citation Examples

Home
Sitemap
Directory
Email Us

- TUNL Nuclear Data Group: Who we are and what we do.

**Our publications on Energy Levels of Light Nuclei, A = 5 - 20:**

- Publications: TUNL evaluations of A = 3 - 20, and modified versions of Fay Ajzenberg-Selove's publications of A = 5 - 20, are available here in PDF format. The most recent HTML documents of A = 3 - 20, and EL diagrams of A = 4 - 20 are also available here. Some reprints and preprints may be requested by mail.
- HTML for Nuclides: HTML documents are available for individual nuclides found within the TUNL or FAS evaluations.

**Resources relating to our publications:**

- Energy Level Diagrams are available for A = 4 - 20 nuclides.
- Tables of Energy Levels: a brief listing of tables of energy levels from the most recent publication for each nuclide A = 4 - 20.
- SiteMap and Complete List of Available TUNL Documents: Trying to find a specific TUNL evaluation or preliminary report, HTML document, General Table, Update List or Energy Level Diagram? Click here for a complete list of what's available on our website.

**Applications and databases relating to the A = 3 - 20 nuclides:**

- NSR Key Number Retrieval
- ENSDF: Information for A = 2 - 20 nuclides available through the National Nuclear Data Center (NNDC) site.
- Excitation Functions: Compilation of the excitation functions for various (p, X) and (α, X) reactions.
- Thermal Neutron Capture Data: Summary of level and branching intensity data measured in Thermal Neutron Capture.
- Ground-State Decay Data: Summary of half-life, branching intensity, and mass excess data measured in ground state beta- and charged-particle-decay.
- Half-Lives Table: List table of nuclear decay half-lives.
- NuDat at BNL: Allows to search and plot nuclear structure and nuclear decay data interactively.

**Helpful links:**

- TUNL Dissertations: Online access of TUNL dissertations collection. This site is in progress.

- Submitted ENSDF for *A*=12
- Prepared/updated ENSDF datasets for
  - $^{5,6}$H, $^{5}$Be, $^{19,20,21}$B, $^{8,20}$C, $^{11}$O, $^{10,19,20}$N, $^{17}$Ne
  - Maintain up-to-date β-decay lifetimes for *A*=1-20
- Work in progress:
  - Preparing *A*=13 ENSDF file
  - Preparing evaluations of $^{6}$Be, $^{17}$O
  - Update β-decay datasets in ENSDF

    $^{17}$Ne (β, β-n , β–α)

# Comments on β-decay lifetimes

Research Experience for Undergraduate Project (Susan Olmstead) in 2015:

- Compiled relevant articles
- Use McMaster data group's Java averaging program
- Evaluated lifetimes using a variety of averaging methods
- Produced a table of recommended values

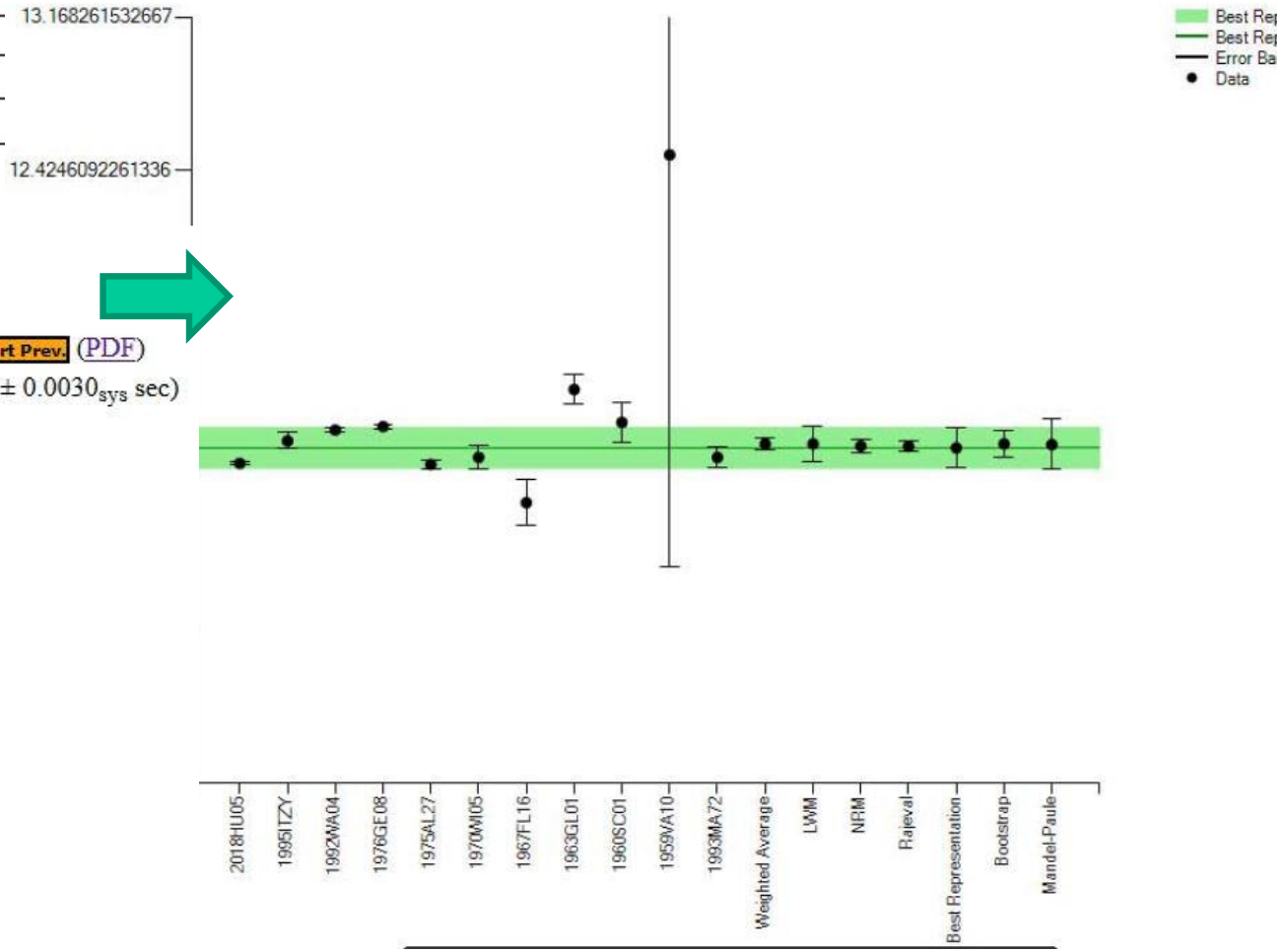
| Nuclide ($\beta^-$ Decay) | Half-Life | Date | Nuclide ($\beta^+$ Decay) | Half-Life | Date |
|---|---|---|---|---|---|
| $^{3}$H | 12.323 ± 0.020 yr | September, 2015 | $^{7}$Be | 53.22 ± 0.06 days | August, 2001 |
| $^{6}$He | $806.89^{+0.25}_{-0.22}$ ms | August, 2015 | $^{8}$B | 770.3 ± 0.4 ms | July, 2015 |
| $^{8}$He | 119.0 ± 1.6 ms | September, 2015 | $^{9}$C | 126.5 ± 1.0 ms | July, 2015 |
| $^{8}$Li | 838.79 ± 0.36 ms | August, 2015 | $^{10}$C | 19.3015 ± 0.0017 sec | May, 2016 |
| $^{9}$Li | 177.7 ± 0.6 ms | August, 2015 | $^{11}$C | 20.3401 ± 0.0070 min | March, 2018 |
| $^{10}$Be | $(1.51 \pm 0.06) \times 10^{6}$ yr | August, 2015 | $^{12}$N | 11.000 ± 0.016 ms | August, 2015 |
| $^{11}$Li | 8.74 ± 0.15 ms | August, 2015 | $^{13}$N | 9.967 ± 0.005 min | July, 2015 |
| $^{11}$Be | 13.77 ± 0.08 sec | July, 2015 | $^{13}$O | 8.58 ± 0.07 ms | July, 2015 |
| $^{12}$Be | 21.46 ± 0.05 ms | September, 2015 | $^{14}$O | 70.616 ± 0.020 sec | February, 2016 |
| $^{12}$B | 20.22 ± 0.04 ms | September, 2015 | $^{15}$O | 122.22 ± 0.32 sec | September, 2015 |
| $^{13}$B | 17.30 ± 0.17 ms | July, 2015 | $^{17}$F | 64.385 ± 0.053 sec | April, 2016 |
| $^{14}$Be | 4.65 ± 0.20 ms | August, 2015 | $^{17}$Ne | 109.2 ± 0.6 ms | July, 2015 |
| $^{14}$B | 12.6 ± 0.6 ms | July, 2015 | $^{18}$F | 109.733 ± 0.011 min | July, 2015 |
| $^{14}$C | 5686 ± 40 yr | September, 2015 | $^{18}$Ne | 1.66428 ± 0.00060 sec | August, 2015 |
| $^{15}$B | 10.00 ± 0.11 ms | September, 2015 | $^{19}$Ne | 17.258 ± 0.008 sec | January, 2018 |
| $^{15}$C | 2.450 ± 0.005 sec | August, 2015 | $^{20}$Na | 447.9 ± 2.3 ms | September, 2015 |
| $^{16}$C | 0.750 ± 0.008 sec | September, 2015 | $^{20}$Mg | 90.4 ± 0.7 ms | April, 2017 |
| $^{16}$N | 7.13 ± 0.02 sec | August, 2015 | | | |
| $^{17}$B | 5.07 ± 0.05 ms | August, 2015 | | | |
| $^{17}$C | 193 ± 6 ms | July, 2015 | | | |
| $^{17}$N | 4.173 ± 0.004 sec | July, 2015 | | | |
| $^{18}$C | 92 ± 2 ms | July, 2015 | | | |
| $^{18}$N | 0.619 ± 0.002 sec | July, 2015 | | | |
| $^{19}$B | 2.92 ± 0.13 ms | July, 2015 | | | |
| $^{19}$C | 46.3 ± 4.0 ms | September, 2015 | | | |
| $^{19}$N | 0.336 ± 0.003 sec | August, 2015 | | | |
| $^{19}$O | 26.470 ± 0.018 sec | August, 2015 | | | |
| $^{20}$C | $16.3^{+4.0}_{-3.5}$ ms | September, 2015 | | | |
| $^{20}$N | 134.4 ± 3.7 ms | August, 2015 | | | |
| $^{20}$O | 13.51 ± 0.05 sec | July, 2015 | | | |
| $^{20}$F | 11.076 ± 0.099 sec | June, 2018 | | | |

# β-decay lifetimes -continued

| Nuclide | Method | Value | Quality Factor | Outliers | Recommended |
|---|---|---|---|---|---|
| 20F | Unweighted Average | 11.22(14) sec | N/A | None | 11.076(99) sec |
| | Weighted Average | 11.096(27) | $Chi^2$: 34.73 | | |
| | Limit. of Stat. Weights | 11.096(87) | $Chi^2$: 34.73 | | |
| | Normalization Residuals | 11.085(30) | $Chi^2$: 3.18 | | |
| | Rajeval Technique | 11.084(27) | $Chi^2$: 2.13 | | |
| | MBR (Method of Best Representation) | 11.076(99) | 93.50% | | |
| | Boostrap | 11.095(64) | $Chi^2$: 34.73 | | |
| | Mandel-Paule | 11.09(12) | $Chi^2$: 34.79 | | |

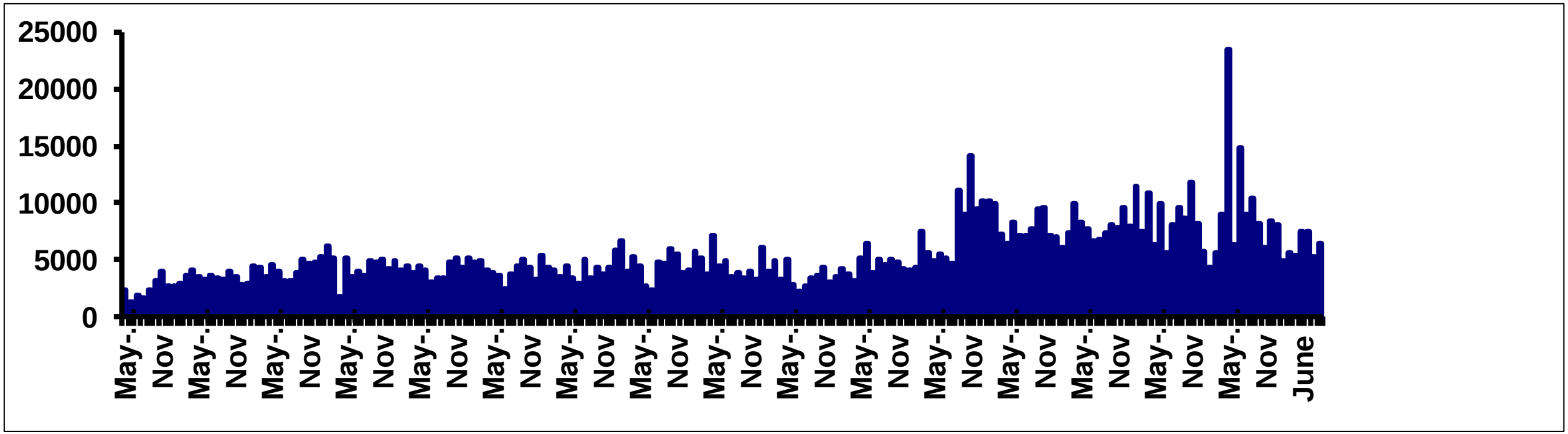
**Measured half-life for $^{20}F(\beta^-)^{20}Ne$**

| | | |
|---|---|---|
| Recommended value (June, 2018): | 11.076 ± 0.099 sec | (Method of Best Representation) |
| Summary Table of Uncertainty Analysis: | Table Prev. (PDF); | Summary chart of all values: Chart Prev. (PDF) |
| Measured values: | 11.0011 ± 0.0076 sec | (2018HU05: 11.0011 ± $0.0069_{stat}$ ± $0.0030_{sys}$ sec) |
| | 11.11 ± 0.04 sec | (1995ITZY) |
| | 11.03 ± 0.05 sec | (See 1993MA72) |
| | 11.163 ± 0.008 sec | (1992WA04) |
| | 11.18 ± 0.01 sec | (1976GE08) |
| | 10.996 ± 0.020 sec | (1975AL27) |
| | 11.03 ± 0.06 sec | (1970WI05) |
| | 10.81 ± 0.11 sec | (1967FL16) |
| | 10.31 ± 0.07 sec | (1967YU01) (Excluded) |
| | 11.36 ± 0.07 sec | (1963GL01) |
| | 11.56 ± 0.05 sec | (1962MA38) (Excluded) |
| | 11.2 ± 0.1 sec | (1960SC01) |
| | 12.5 ± 2.0 sec | (1959VA10) |
| | 11.4 sec | (1954WO23) (Excluded) |
| Other Reviews: | 11.150 ± 0.021 sec | (Our analysis in August, 2015) |



- eXperimental Unevaluated Nuclear Data Library
  - Usually 50-60 data sets/year (~5/month)
- Compilation of ground state decay & β-decay references and data
- Compilation of (p,X) and (α,X) excitation functions
- Compilation of thermal neutron capture references and data
- Maintain TUNL Dissertations online

# 2018: Σ=80 k




Using Analog - finding issues with excluding new search engine "robots"