

# NJOY2016 (and NJOY2012) Status

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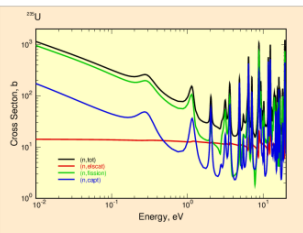
Presented at the  
IAEA Consultant's Meeting on  
International Radiation Characterization Benchmark Experiment  
Project (IRCBEP)

August 6 – 8, 2018  
Vienna, Austria

Atomic Properties of the Elements

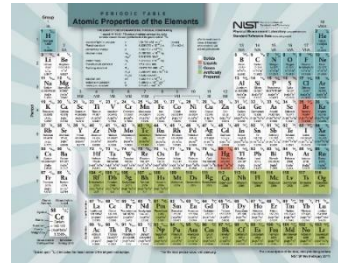
This is a periodic table of elements with various atomic properties listed for each element. The table is color-coded by groups and includes columns for atomic number, symbol, name, and atomic weight. It also includes sections for physical and chemical properties.

# NJOY2016 (and NJOY2012)

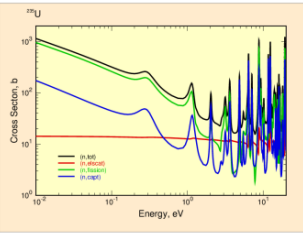


- NJOY2016 is the official NJOY production version.
  - ... currently NJOY2016.39 (03jul18).
- Primary code developers are Jeremy Conlin ([jlconlin@lanl.gov](mailto:jlconlin@lanl.gov)) and Wim Haeck ([wim@lanl.gov](mailto:wim@lanl.gov)).
- NJOY users can communicate with the developers via [njoy@lanl.gov](mailto:njoy@lanl.gov).
- NJOY2012 is nearing end-of-life support ...
  - At the Fall 2017 CSEWG meeting LANL promised NJOY2012 support through 9/30/2018, but LANL's legacy NJOY web pages (<http://t2.lanl.gov/nis/codes/NJOY12/>) are no longer maintained.
  - Latest available update from LANL is NJOY2012.82 (posted 2/3/2017).
  - Latest available update from the NEA is NJOY2012.99 (posted 8/2/2017).
    - **Neither of these NJOY2012 versions can process the entire ENDF/B-VIII.0 neutron release.**
    - **Last minute revisions to the new fission multiplicity format impact one or more of <sup>235,238</sup>U and <sup>239</sup>Pu.**
  - The IAEA has contracted to receive additional NJOY2012 updates that maintain equivalence with NJOY2016 ... a upn file for NJOY2012.134 is equivalent to NJOY2016.39.

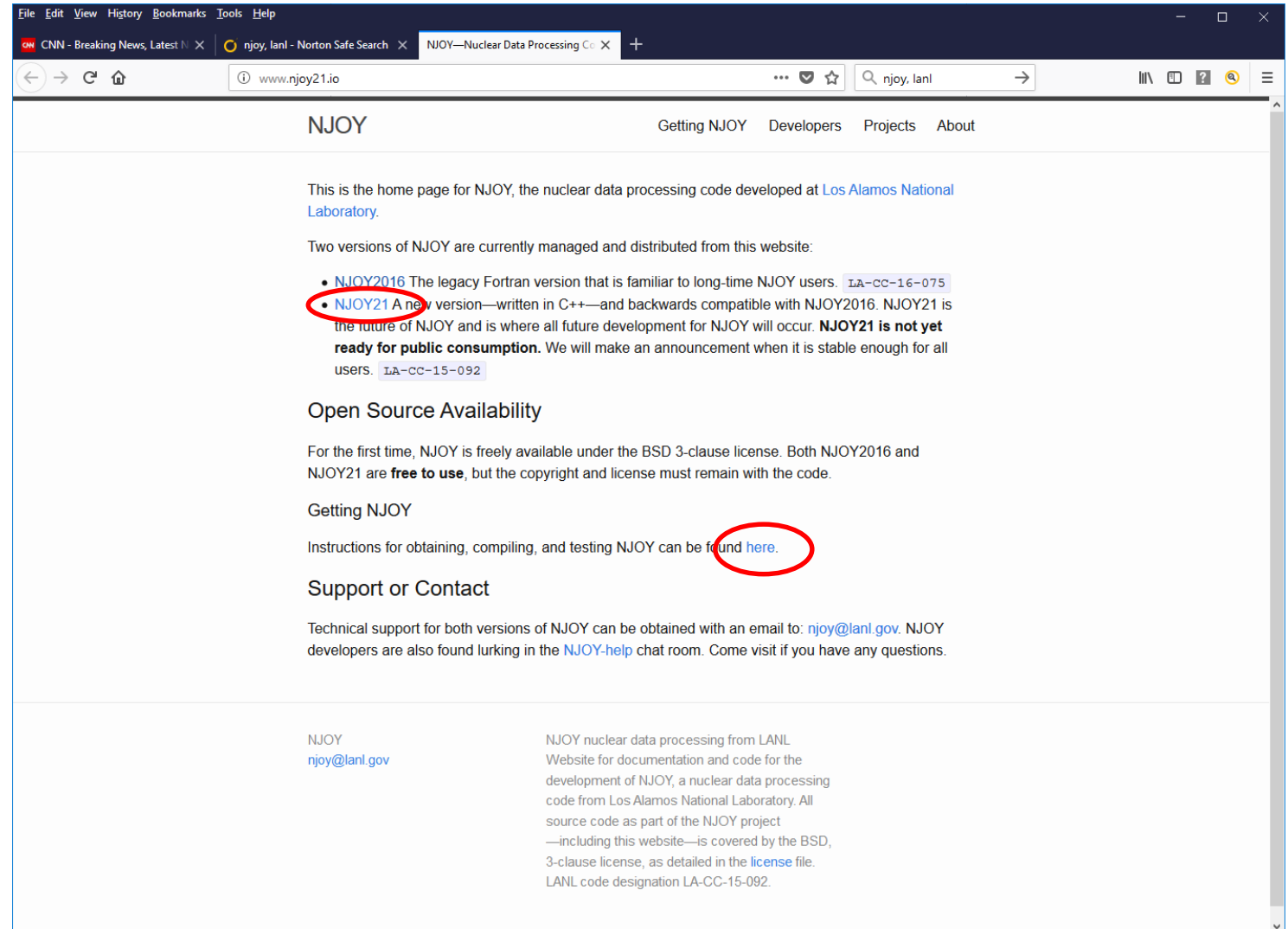
# NJOY2016



Periodic Table of Elements showing atomic properties. The table includes columns for Atomic Number, Symbol, Name, and Atomic Weight. It is color-coded by groups and includes data for various elements.

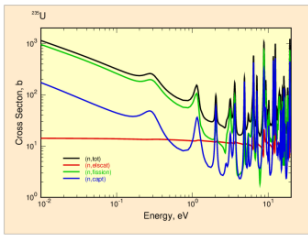


- The NJOY home page ...
- <http://njoy.lanl.gov/>
- NJOY2016 is “open source” ... i.e., freely available to all.
- NJOY2016 and earlier only process ENDF evaluations that use the legacy card-image format.
- The next major NJOY release, NJOY21, will be GND compatible.



The screenshot shows the NJOY website homepage. The browser address bar displays [www.njoy21.io](http://www.njoy21.io). The page content includes:

- Navigation links: Getting NJOY, Developers, Projects, About
- Introduction: "This is the home page for NJOY, the nuclear data processing code developed at Los Alamos National Laboratory."
- Version information: "Two versions of NJOY are currently managed and distributed from this website:"
  - **NJOY2016** The legacy Fortran version that is familiar to long-time NJOY users. [LA-CC-16-075](#)
  - **NJOY21** A new version—written in C++—and backwards compatible with NJOY2016. NJOY21 is the future of NJOY and is where all future development for NJOY will occur. **NJOY21 is not yet ready for public consumption.** We will make an announcement when it is stable enough for all users. [LA-CC-15-092](#)
- Open Source Availability: "For the first time, NJOY is freely available under the BSD 3-clause license. Both NJOY2016 and NJOY21 are **free to use**, but the copyright and license must remain with the code."
- Getting NJOY: "Instructions for obtaining, compiling, and testing NJOY can be found [here](#)." (The word "here" is circled in red in the original image.)
- Support or Contact: "Technical support for both versions of NJOY can be obtained with an email to: [njoy@lanl.gov](mailto:njoy@lanl.gov). NJOY developers are also found lurking in the [NJOY-help](#) chat room. Come visit if you have any questions."
- Footer: "NJOY nuclear data processing from LANL. Website for documentation and code for the development of NJOY, a nuclear data processing code from Los Alamos National Laboratory. All source code as part of the NJOY project—including this website—is covered by the BSD, 3-clause license, as detailed in the [license](#) file. LANL code designation LA-CC-15-092."



# NJOY2016

➤ The NJOY home page ...

➤ <http://njoy.lanl.gov/>

➤ Instructions on how to obtain the code ...

➤ <http://www.njoy21.io/Build/>

NJOY Getting NJOY Developers Projects About

## Obtaining and Installing NJOY

- For the impatient
  - Prerequisites
  - Build Process
    - Downloading
      - Updating NJOY to Incorporate Changes
    - Configuring
    - Compiling/Building
    - Testing
    - Building Offline
  - Compliant Compilers
    - C++14 Compliant Compiler
    - Fortran 2003 Compliant Compiler

Both NJOY21 and NJOY2016 use the same configuration and build process. Additionally, all of the supporting projects use the same process.

### For the impatient

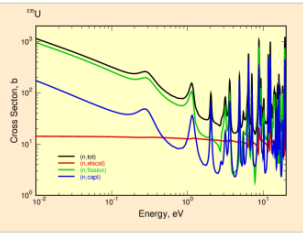
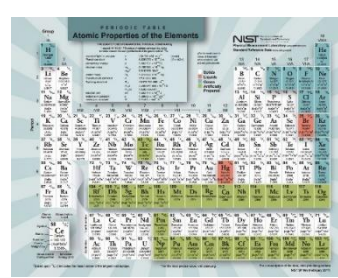
```
# Download the source code
git clone https://github.com/njoy/NJOY2016.git

# Configure the build process
cd NJOY2016
mkdir bin
cd bin
cmake ../

# Build NJOY16
make

# Test NJOY16
make test
```

# NJOY2016



➤ The NJOY home page ...

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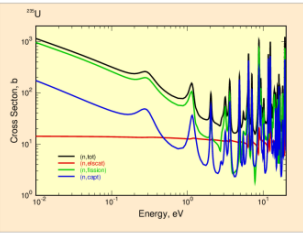
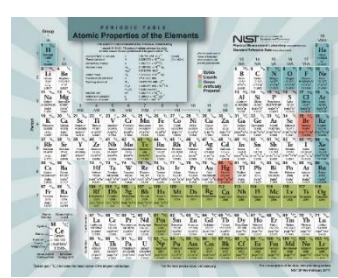
➤ ... or if you are not GitHub literate ...

➤ <https://github.com/njoy/NJOY2016>

The screenshot shows the GitHub repository page for `njoy/NJOY2016`. The repository has 397 commits, 29 branches, 7 releases, and 5 contributors. The 'src' directory is highlighted with a red circle. The 'Clone or download' button is also highlighted with a red circle.

File	Description	Time
<code>.travis</code>	Adding command to update pip before running coversalls.	a year ago
<code>docs</code>	Updating test documentation.	16 days ago
<code>metaconfigure</code>	Appveyor testing.	9 months ago
<code>src</code>	Reverted some unnecessary changes	16 days ago
<code>tests</code>	Changed njoy version and date	a month ago
<code>.gitignore</code>	Revamping test descriptions.	2 years ago
<code>.travis.yml</code>	Updating test documentation.	16 days ago
<code>CMakeLists.txt</code>	pedantic removed	a year ago
<code>Dockerfile</code>	Adding dockerfile that builds and passes all tests when run.	8 months ago

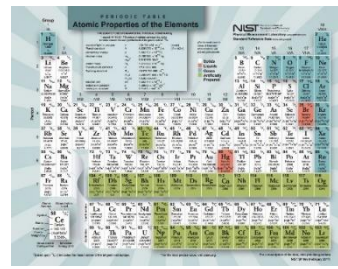
# NJOY2016



- ... or if you are not GitHub literate ...
- <https://github.com/njoy/NJOY2016>
- “scr” folder contains all \*.f90 source code routines.
- vers.f90 contains the current version
- main.f90 was called njoy.f90 in NJOY2012 and earlier code releases.

Commit	Description	Time Ago
endf.f90	Implementing Skip's fix for this MF6/MT18 format change.	9 months ago
errorr.f90	Changes following review	3 months ago
gamindr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
gaspr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
graph.f90	should have used git move	2 years ago
groupr.f90	Changes following review	3 months ago
heatr.f90	Corrected an issue in heatr (when using multiple temperatures, hinit ...	6 months ago
leapr.f90	Wim's solution is nicer	3 months ago
localc.f90	Updating to latest src file from Kahler.	2 years ago
<b>main.f90</b>	*merged changes from upd repository commit 87dd33dbc3d4d3a2a07559155e...	11 months ago
mainio.f90	Updating to latest src file from Kahler.	2 years ago
mathm.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
matxsr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
mixr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
moder.f90	Implemented the use of MT458 LFC=1 tabulated components and modified ...	7 months ago
phys.f90	should have used git move	2 years ago
plotr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
powr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
purr.f90	Fixed an issue with an out of bound index in purr	3 months ago
reconr.f90	error message in RECONR modified. suppress negative cross section err...	3 months ago
resxsr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
samm.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
thermr.f90	Fixed an issue in thermr when iform=1 due to the incident energy arra...	4 months ago
unresr.f90	Reverted some unnecessary changes	19 days ago
util.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
<b>vers.f90</b>	Updated NJOY version and date	19 days ago
viewr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago
wimsr.f90	*merged changes from upd repository commit a7d5f29285b8ed73f1e4c9a135...	2 years ago

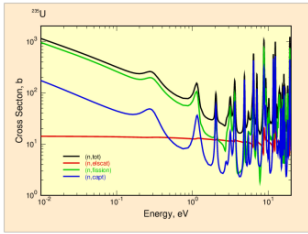
# NJOY2016 (and NJOY2012)



A periodic table of elements with various atomic properties listed for each element. The table is color-coded and includes columns for atomic number, symbol, name, and various physical and chemical properties. The title is "Atomic Properties of the Elements" and it is attributed to NIST.

## ➤ Issues resolved with recent updates include:

- NJOY2016.39, July 3, 2018 (2012.134): NaN's in UNRESR. Could occur if URR parameters are not defined over the entire URR energy range. An evaluation error that should not occur.
- NJOY2016.38, June 18, 2018 (2012.133): Possible array overflow in BROADR. Could occur if the user "thnmax" input variable was too close to the maximum energy mesh.
- NJOY2016.37, June 12, 2018 (2012.132): Revised coding in ACER to more accurately process charged particle recoil.
- NJOY2016.36, June 6, 2018 (2012.131): Revise a RECONR information message to more fully define the action taken when the elastic scattering cross section is too small ( $\leq 1.0 \mu\text{barn}$ ), or negative.
- NJOY2016.35, April 30, 2018 (2012.128 – 2012.130): Several issues, including more robust array allocation in PURR, detect possible negative cross sections in PURR's probability tables (caused by  $\sigma(\text{tot})$  being less than the sum of its components ... another evaluation error that should not happen, sigh), small revision to the internal mt153 section format (which impacts both PURR and ACEFC).
- NJOY2016.34, April 17, 2018 (2012.127): An earlier update allows the user to specify "ismooth" as an input variable. Modify ACER's standard output to fully identify the chosen option.
- NJOY2016.33, April 9, 2018 (2012.126): Several revisions in LEAPR for more robust interpolation.



# NJOY2016 (and NJOY2012)

- Further information on recent NJOY2016 updates is available from LA-UR-18-22676, “NJOY2016 Updates for ENDF/B-VIII.0” (<http://permalink.lanl.gov/object/tr?what=info:lanl-repo/lareport/LA-UR-18-22676>).
- Additional information can be found in LA-UR-18-24034, “Release of ENDF/B-VIII.0-Based ACE Data Files” ... in the “docs” folder at <https://nucleardata.lanl.gov/ACE/Production/Lib80x.html>.
- In conclusion ...
  - NJOY, and (IMHO) all processing codes remain a “work in progress”.
  - They must respond to ever changing evaluated file format revisions.
  - NJOY is not a checking code, but evaluated file checks are increasingly necessary.
  - NJOY continues to transition to using array allocation ... but fixed arrays remain and it is not always possible to know beforehand how much space may be needed.
    - Compiling with array bounds checking turned on may cause a near term performance hit ... but that’s better than running long term simulations with incorrect data!