LISE++ version 9.2.159

- Update of isotope discovery history
- Update of Statistics window
- Extended version of the Isotope dialog: Decay analysis
- Decay mode revision
- Color editing of the table of nuclides
- Update of LISE for Excel
- Miscellaneous
History of isotope discovery

9.2.127 28/11/11  Implemented: Isotope Discoveries of elements Ca, In, Sn, Pt

39Ca was first observed in 1943 by Huber et al.: “Der Kernphotoeffekt mit der Lithium-Gammastrahlung: I. Die leichten Elemente bis zum Calcium” [2]. 39Ca was populated in a radiative capture reaction with 17 MeV γ-rays. 500 keV protons bombarded lithium to produce the γ-rays from the reaction 7Li(p,γ). Subsequent to the irradiations the decay curves of the emitted β-rays were measured. “Als Resultat von 600 durchgeführten Bestrahlungen erhielten wir die in Fig. 13 aufgezeichnete Zerfalls kurve mit einer Halbwertszeit von T = 1.06 ± 0.03 sec.” (As a result of 600 irradiations we achieved the decay curve shown in Figure 13 with a half-life of T = 1.06 ± 0.03 sec.).


Adapted from
A. Amos, J.L. Gross, and M. Thoennessen
At. Data Nucl. Data Tables 97, 383 (2011)

9.2.131 28/11/11  Show discovery history availability in the chart of nuclides
9.2.129 28/11/11
Call the LISE++ database dialog from the Isotope statistics window

9.2.136 01/12/11
Double click by left mouse button on an isotope in the chart of nuclides -> show only database information on this isotope

9.2.152 07/12/11
Call the “Decay analysis" dialog from the Isotope statistics window

9.2.128 28/11/11
Update of JAEA (Japan Atomic Nuclear Agency Chart) Nuclear Chart - 2010

9.2.130 28/11/11
Beta+ & Beta- values results are shown in the Isotope statistic window
Extended version of the “Isotope” dialog: “Decay analysis” dialog

9.2.135 01/12/11  Extended version of the isotope dialog
9.2.137 02/12/11  Analysis of “conflict” decay branches

Access from

“Isotope” dialog

Statistics window

“Utility” menu
“Decay analysis” dialog => modes: stable, decay or unbound

According chosen mass model or database

- **Stable. No decay.** $Q_a, b-, b+ < 0$, and $S_1n, S_2n, S_1p, S_2p > 0$
- **Decay.** $Q_a, b-, b+ > 0$, and $S_1p, S_2p < 0$
- **Unbound.** $Qa-CB > 0$, and $S_1p+CB, S_2p+CB, S_1n, S_2n < 0$, where $CB$ – Coulomb Barrier

**1st step**

If after 1st step the mode was set as “decay” then
- Accept as “unbound” if half-life of this mode smaller than “does not exist” threshold

**2nd step**

Accept as “stable” if half-life of this mode greater than “stable” threshold

**3rd step**

- If more than 2 decay modes are present, than only two will be chosen based on short half-life
- If there are two bunches are present, then LISE++ accepts the second mode if its half-life no greater than 1st mode half-life value divided on “2nd branch value” or

$$\left[\frac{T_{1/2}}{2}\right] \times \text{coef} < \left[\frac{T_{1/2}}{2}\right]_1$$
“Decay analysis” dialog => “conflict” decay mode

“conflict” decay mode happens then

Decay mode set in LISE++ chart of nuclides is not the same as the “Decay analysis” dialog predicts

Pay attention, that the Decay analysis is evidently very sensitive to mass model being used. So A&W2003 is good to determinate decay modes for nuclei close to the stability line, but is not good tools to define possible particle-bound isotopes (so called “unknown” mode).

The “ktuy.lme” file gives plenty conflicts even for nuclei close to the stability line 😃
Revision of Decay modes in the LISE++ chart of nuclides

9.2.141 05/12/11 New decays: p & β+, p & α
9.2.144 06/12/11 New decay: β- & α
9.2.147 06/12/11 New decay: SF & β+
9.2.149 06/12/11 New decay: SF & β-

9.2.153 07/12/11 New order of decay modes
=> New iso-file: “table2012.iso”
(instead previous “table.iso”)

9.2.154 08/12/11 Total Revision of Decay modes
in the LISE++ chart of nuclides,
and revision of half-lives of heavy elements
Color editing of the table of nuclides

- Color modifications will be saved in the “lisepp.ini” file (if you have checked “make it default” in the “Isotopes” dialog)
- If you want to restore default LISE++ colors, then erase blocks [Decay_Font], [Decay_Background], [Decay_Label] in the “lisepp.ini” file
Color editing of the table of nuclides

9.2.150 06/12/11  Default text font and background colors for the nuclear chart have been changed

Version 9.1

Version 9.2.159
New functions:

- public **find_line** (x1,y1,x2,y2, x)
- public **find_parabola** (x1,y1,x2,y2,x3,y3, x)
- public **interpolate2** (Xarray, Yarray, x)
- private **interpolate3L** (Xarray, Yarray, x) : based on **find_parabola**. X is between 1\textsuperscript{st} and 2\textsuperscript{nd} parabola points
- private **interpolate3R** (Xarray, Yarray, x) : based on **find_parabola**. X is between 2\textsuperscript{nd} and 3\textsuperscript{rd} parabola points
- public **interpolate3** (Xarray, Yarray, x) : combination of interpolate3L and interpolate3R. Recommended

**Xarray should be sorted!**

-778 : count(Xarray) != count(Yarray)
-777 : at least one cell in Xarray is not value
-776 : Xarray order is wrong. Non-sorted
-775: count(Xarray) < 3
-774: x < min(Xarray)
-773: x > max(Xarray)
-771: at least one cell in Yarray is not value

See example “**test_for_lise_excel.xlsx**”, Sheet “interpolation”
New functions:

Function **MatrixElement** (ByRef M As Object, ByVal row As Integer, ByVal col As Integer) As Double

Function **GetSquareMatrixOrder** (ByRef M As Object) As Integer

Function **MatricesMult** (ByRef M1 As Object, ByRef M2 As Object, ByVal row As Integer, ByVal col As Integer) As Double

Function **MatrixVectorMult** (ByRef Matrix As Object, ByRef Vector As Object, ByVal row As Integer) As Double

Function **MatrixVectorSumSquare** (ByRef Matrix As Object, ByRef Vector As Object, ByVal row) As Double

See example “**test_for_lise_excel.xlsx**” Sheet “matrices”
**New functions:**

- public **A1900_R_Dipole** \((N,B)\), where \(N\) – dipole number, \(B\) – magnetic field (T); return \(R\) in m
- public **A1900_Br_Dipole** \((N,B)\), where \(N\) – dipole number, \(B\) – magnetic field (T); return \(Brho\) in Tm
- private **A1900_R_DipoleX** \((B)\), where \(X\) – dipole number, \(B\) – magnetic field (T); return \(R\) in m
- private **A1900_Br_DipoleX** \((B)\), where \(X\) – dipole number, \(B\) – magnetic field (T); return \(Brho\) in Tm m

See example “**test_for_lise_excel.xlsx**”
Sheet “**A1900_dipoles**”
<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>29/11/11</td>
<td>&quot;inter&quot; modification for Distribution class</td>
</tr>
<tr>
<td>30/11/11</td>
<td>&quot;inter2&quot; modification for Distribution2 class</td>
</tr>
<tr>
<td></td>
<td>changed from interpolation3L to interpolation3 (universal) : see presentation page</td>
</tr>
<tr>
<td>02/12/11</td>
<td>Correction for half-life calculation in the database and isotope dialogs</td>
</tr>
<tr>
<td>05/12/11</td>
<td>Revision of mass constants</td>
</tr>
<tr>
<td>05/12/11</td>
<td>Corrections for 1D plot legends</td>
</tr>
<tr>
<td>06/12/11</td>
<td>New decay spontaneous fission formula : maximum of four other formulas</td>
</tr>
<tr>
<td>08/12/11</td>
<td>Mass excess extrapolation is based now on 4 points instead 3 points from previous version</td>
</tr>
</tbody>
</table>