6630 Final Project Process Book

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Basic Info-

- Title: Visualizing the Sloan Digital Sky Survey
- Members: Anthony Garcia and Stefan Kapetanovic
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- UID: u0805376 and u0871074
- Github Repository: https://github.com/stefankapetanovic/Visualizing-Galactic-Chemical-Distributions-with-SDSS

Overview and Motivation-

As a Physics major, Anthony Garcia has a background in working with researchers in astronomy. His background will be the basis of our gathered data, the approach we take in visualizing the data, and as a source of help/reference when necessary. Our primary motivation, is to encourage exploration of Sloan Digital Sky Survey (SDSS) data by the general public. Trends of chemical composition for stellar objects provide clues to galactic chemical evolution. By providing a means to explore a large set of stars in a visual way, these trends can be visualized. We want to display a very informational dataset of galactic coordinates in a pleasing and visually interactive way.

Project Overview-

Identify and understand the chemical distribution trends found in the Milky Way Galaxy. We also would like to dedicate a portion to exploratory eye-candy for the general public. Exploratory results will heed star sizes, star temperatures, star distances relative to Earth, etc. Providing unique and interactive celestial visuals with a informational backing will be our primary focus.

Data-

Our SDSS DR14 data that has been crossmatched with GAIA observations. This data is formulated and structured to reflect the entire Milky Way Galaxy. It includes data on thousands of stars. Some of the data present is name, size, temperature, velocity, chemical abundance, etc. These data elements are what our projects basis will formulate around.

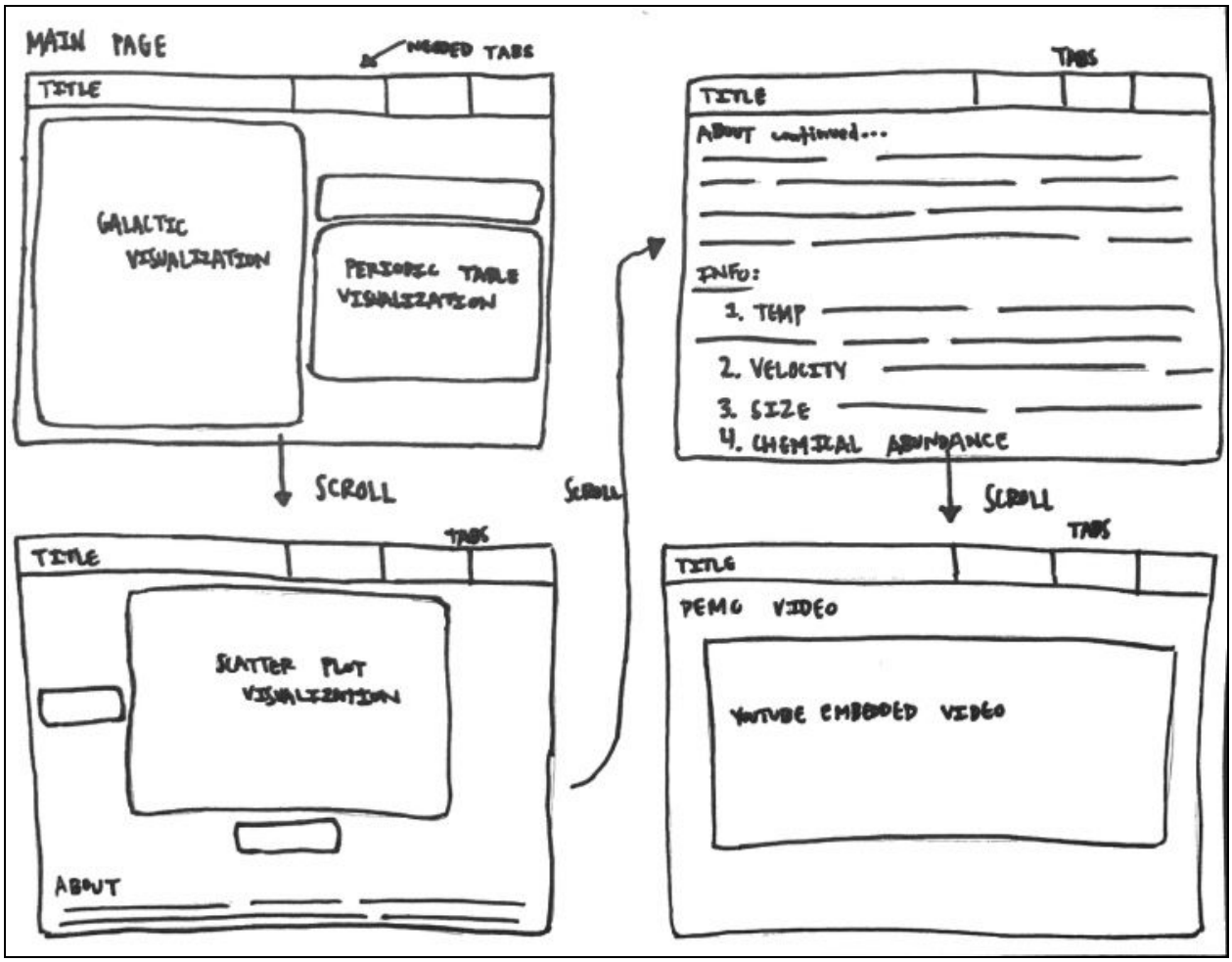
Data Processing-

Cross Matching between identification numbers will be made between two different data sets will need to be performed. Derived data will be mostly positional information. Converting from one coordinate system (helio coordinates) to another (galactic central). We may also need to transform our chemical abundance values to be with respect to another element. For example, number of carbon atoms relative to the number of iron atoms may need to be converted to number of carbon atoms relative to nitrogen atoms.

Visualization Design Draft-

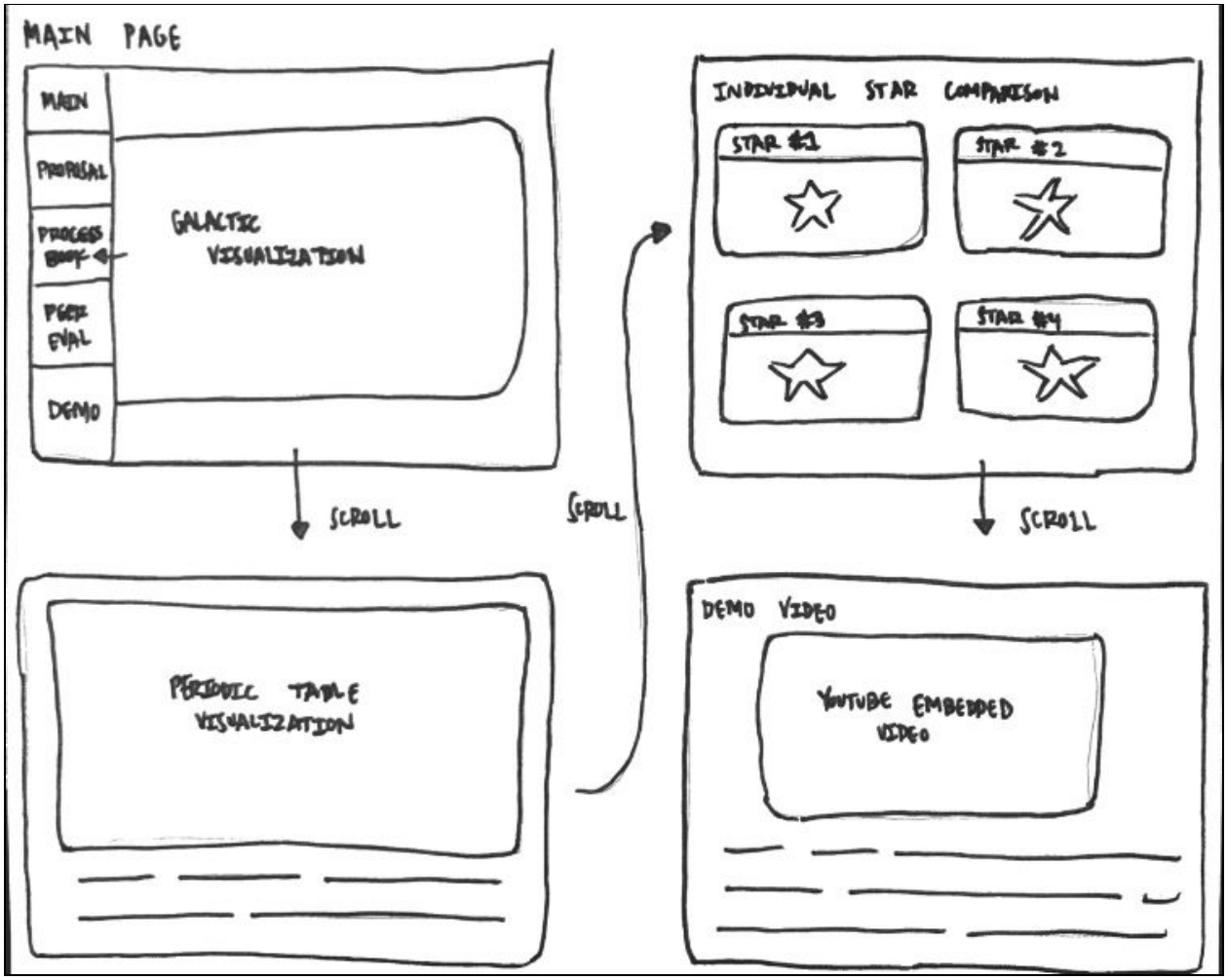
An overview of the designs are given below. Each design gives it pros and cons while explaining what is included into the final design. We include the layout of our visualizations but not the visualizations themselves because they will be constructed in the coming weeks. The general outlines of the three major visualizations we plan on certainly having include a galactic representation visual with stars and interactivity, the second is an interactive periodic table of elements, and the third is a scatter plot where the user can adjust axes.

Final Design:



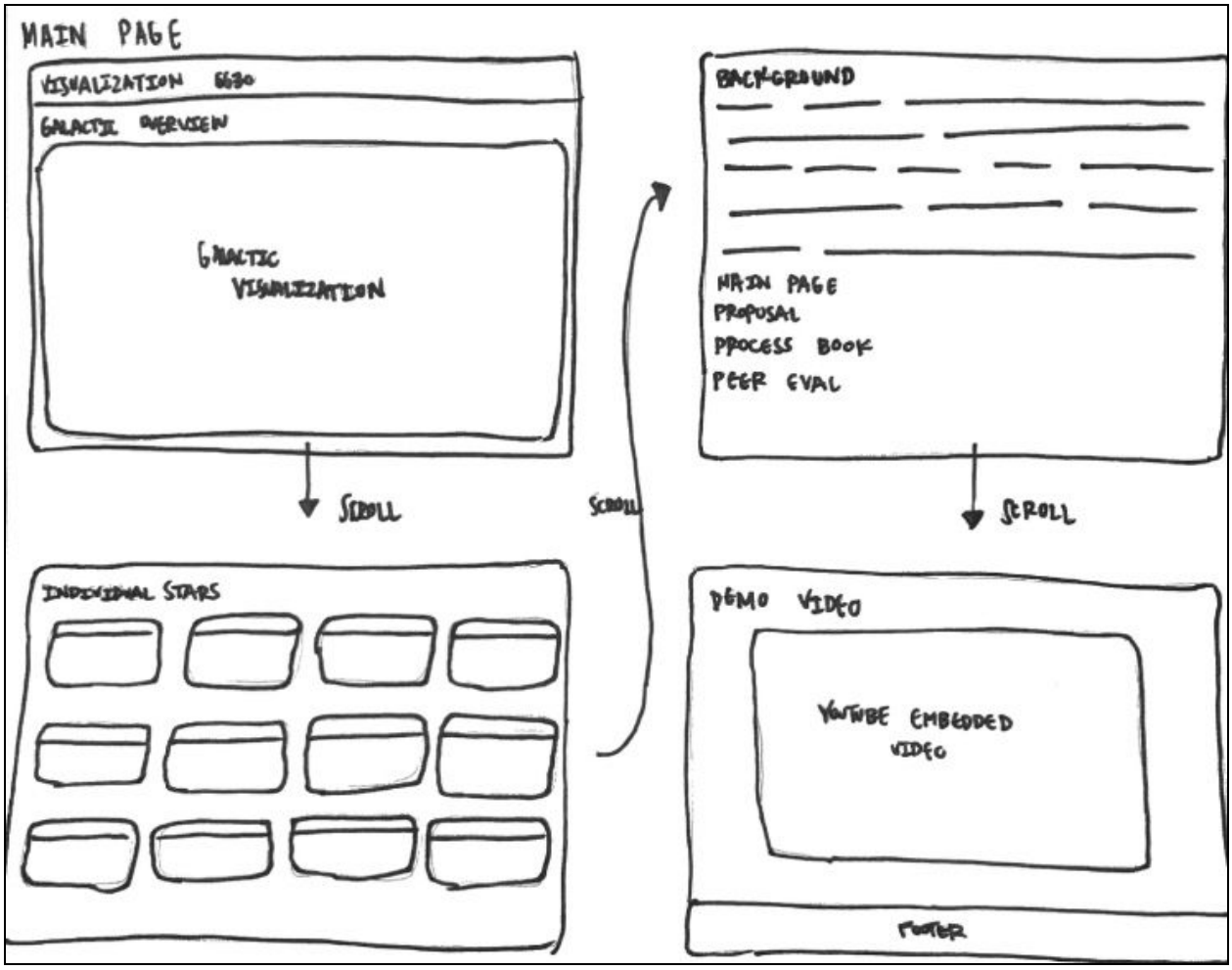
Our final design envelopes the overarching theme of space. We believe it's an elegant and aesthetic approach to display celestial information. It is fully scrollable on one webpage but the tabs at the top directly and smoothly takes you to the section you want to view. We know we want at a minimum three different visualizations that are all connected. The major visualization on the main page will be directly interactive while the scatter plot will respond to the choices made above by the user. The major visualizations include a galactic overview and the periodic table of elements. All the designs incorporate the demo video at the end of the webpage so the user has the opportunity to go through the entire site and then watch a video about full interactivity.

Design 2:



Our second design was interesting because it contained a collapsable side view that would direct you to the sections you wanted to view. We also had an interesting idea of star comparison but ultimately determined that we could get more interactivity and visual intrigue in a different way. This design separates the galactic visualization of the Milky Way and the periodic table. We decided we wanted these two to be interactive and change as the user played with the chemicals in the table and thus the stars would change. We will combine those visuals so they are easily and elegantly seen side by side.

Design 3:



This design provided our main visualization as the only major interactive piece. We wanted to balance our staple piece but also knew we'd need more visualizations to be a great project. Below the major visualizations were a series of stars and their entire scope demographics (i.e. name, size, velocity, temperature, etc.). This design ultimately had too much text throughout that we didn't like as a team. We wanted our visuals to convey everything they needed in the least amount of text. This will be a tricky design test that we will play around with as the project progresses.

Must-Have Features-

1. Positional information related to chemical abundance
2. Interaction to change between elements and different quantities (ex. Temperature, mass, velocity, chemical abundance, etc.)
3. Interaction with the periodic table of elements and the galactic visualization
4. Scatter plot relation plot. With axis adjustments available

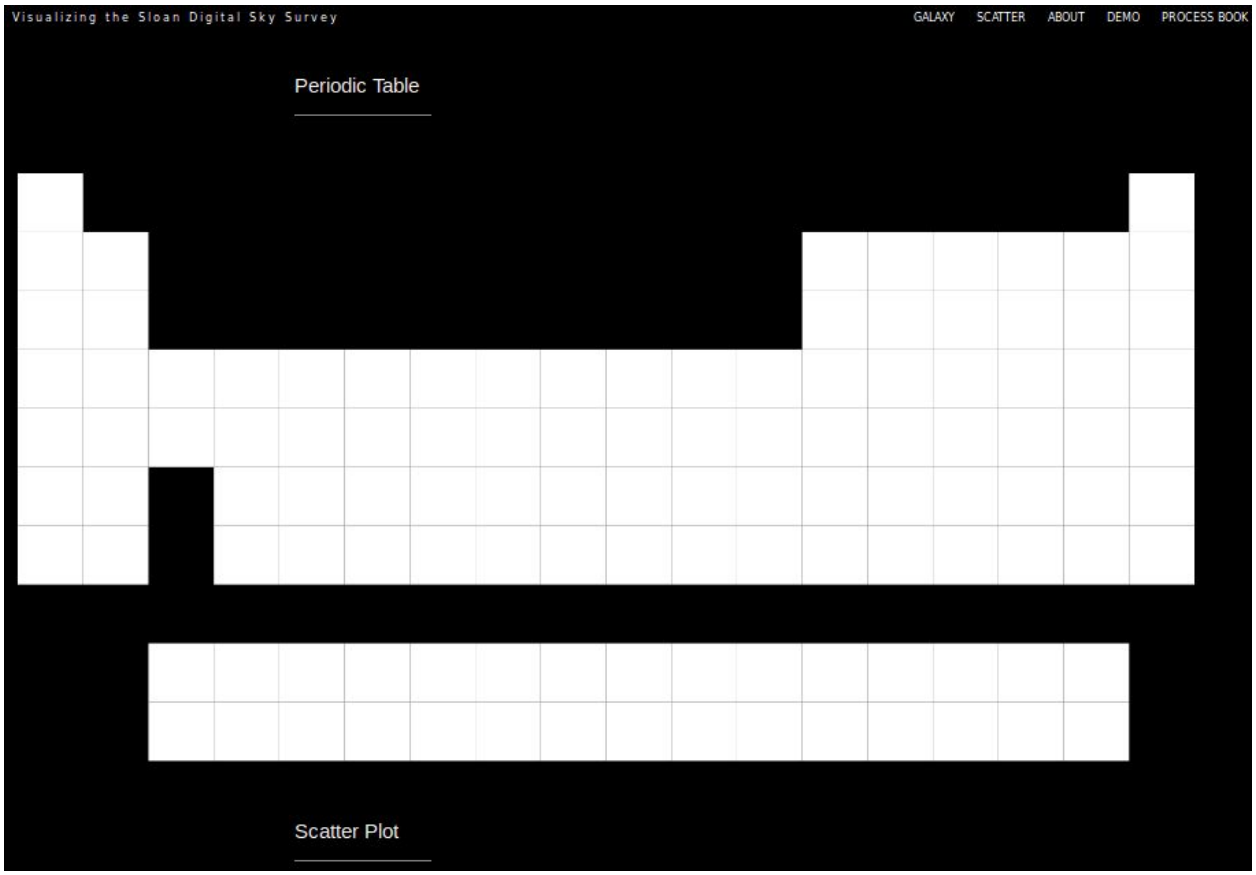
Optional Features-

1. Exoplanet cross reference. (Stars that are known to have planets orbiting them)
2. Visual background of a galaxy
3. Brush selection in scatter plot that will highlight in galactic plot

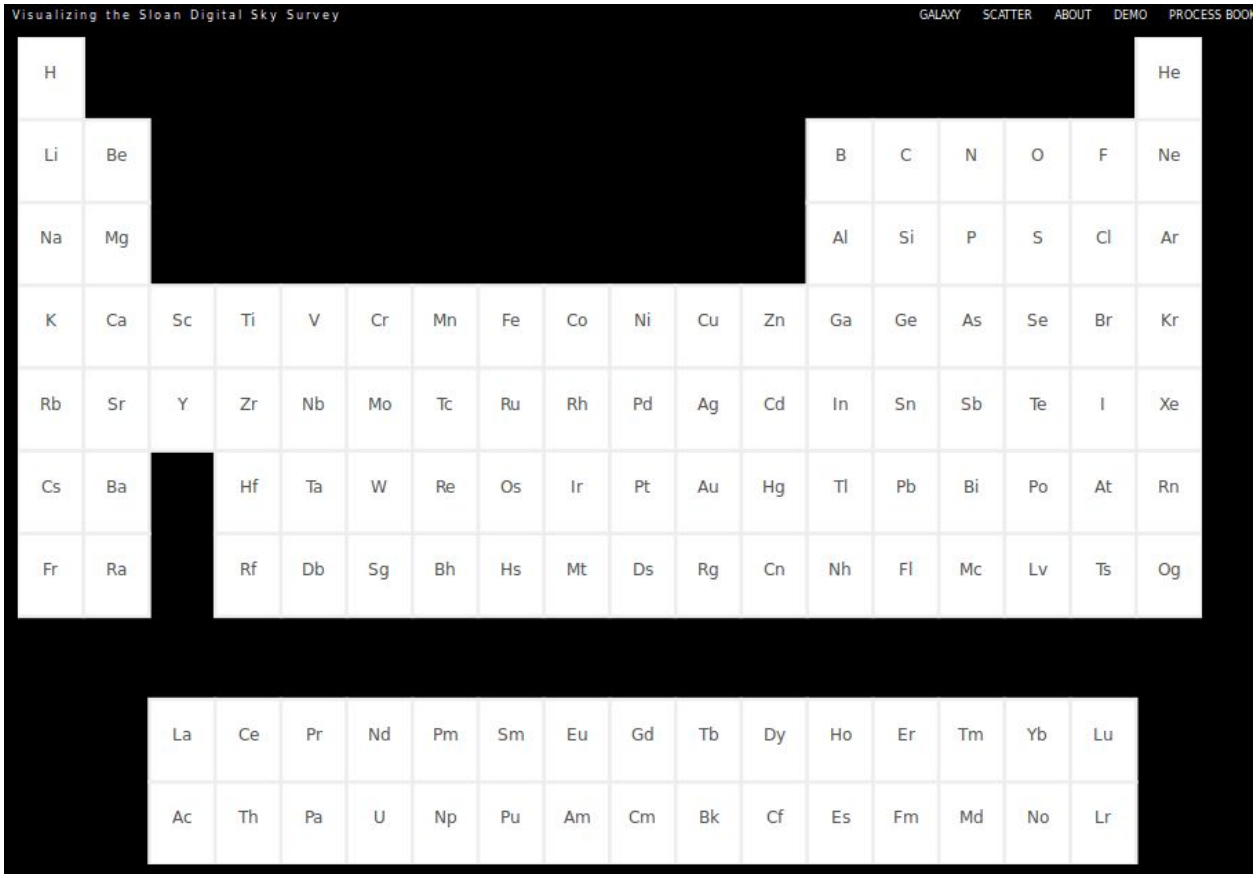
Design Progression-

Periodic Table Visual-

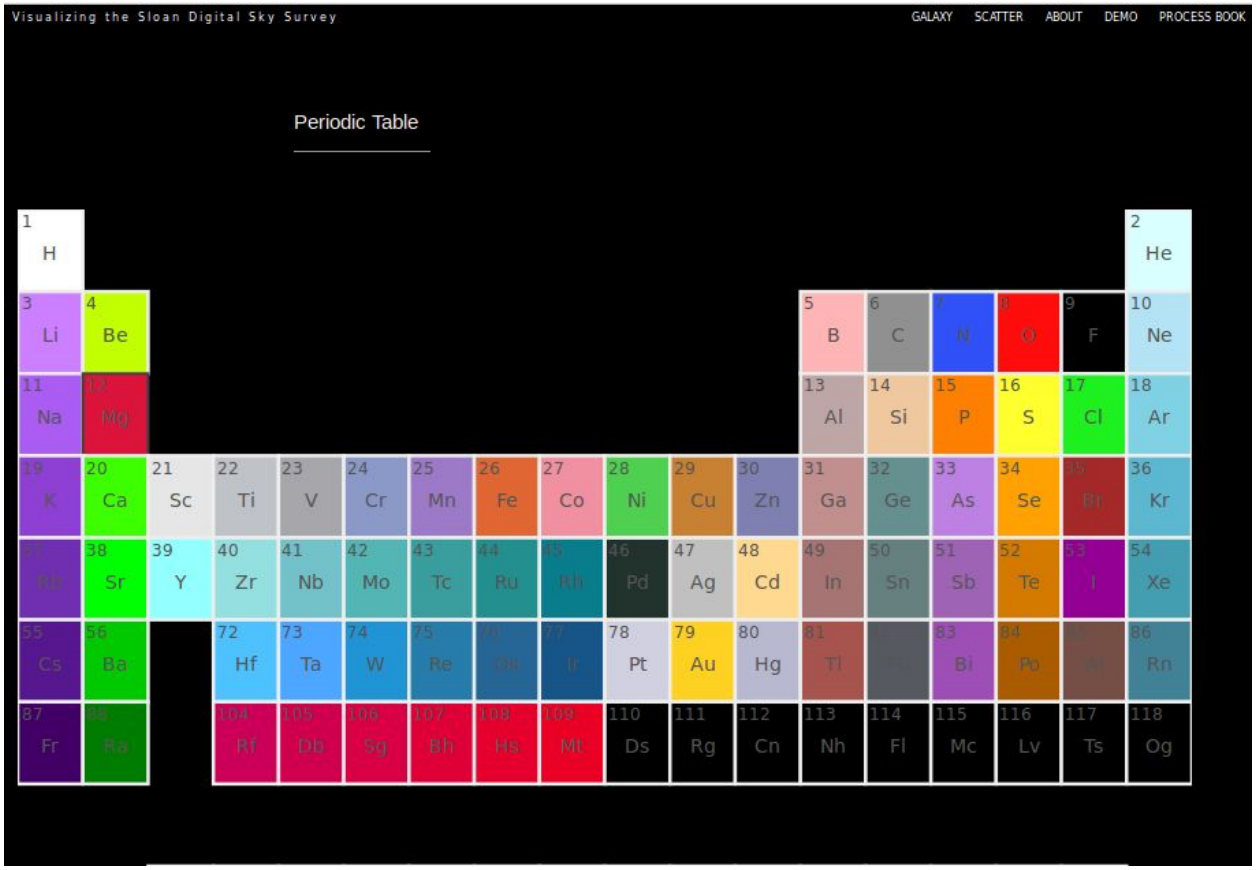
The first visualization we began working on was the periodic table that will correlate to the chemical abundance in the stars. The initial view directly below will display all the chemicals and let the user know what type of chemical they are (i.e. man made, etc.)



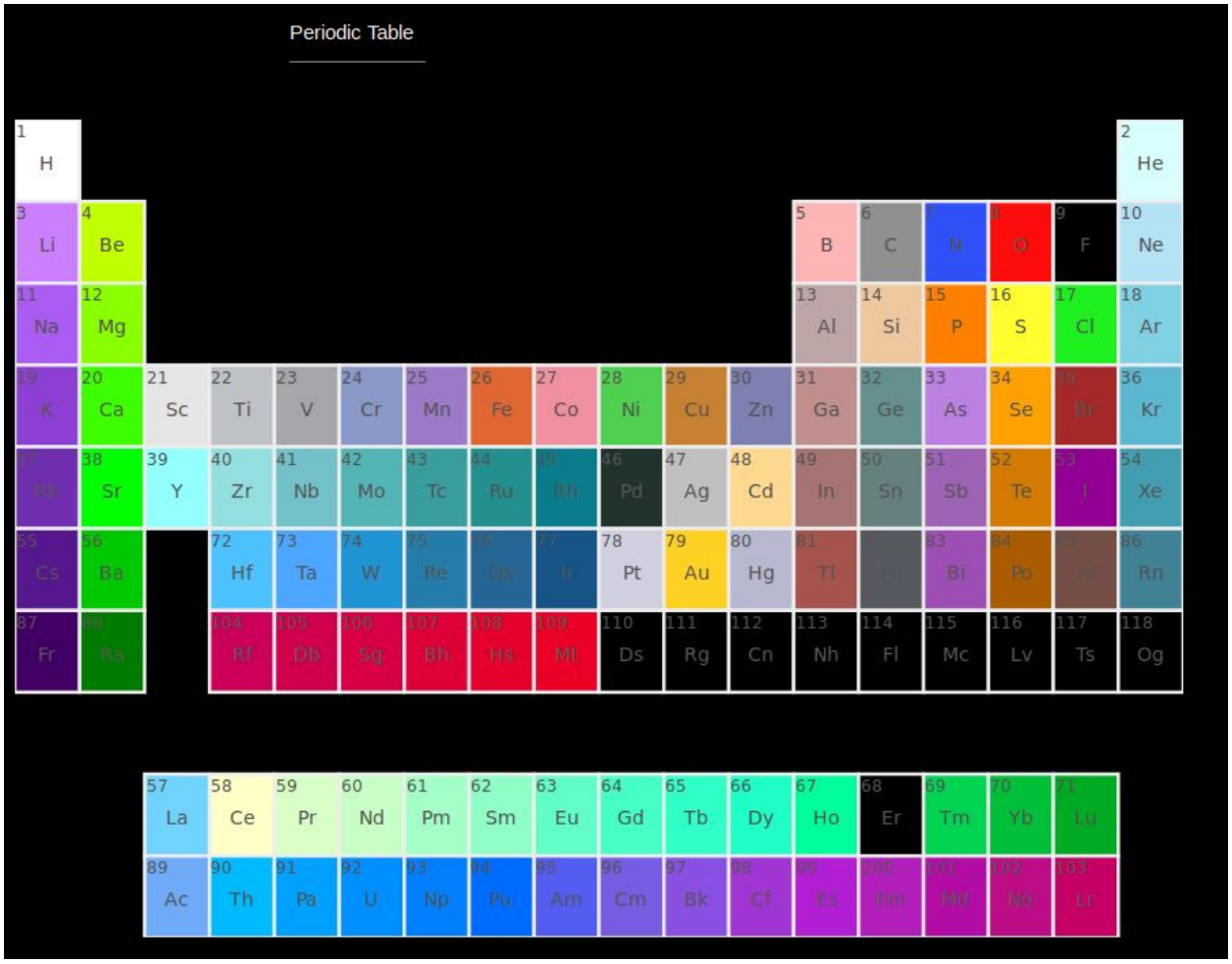
The next progression shown is a view that required our table to directly match or data cells. At this point we started thinking about the data and labeling the chemicals accordingly.

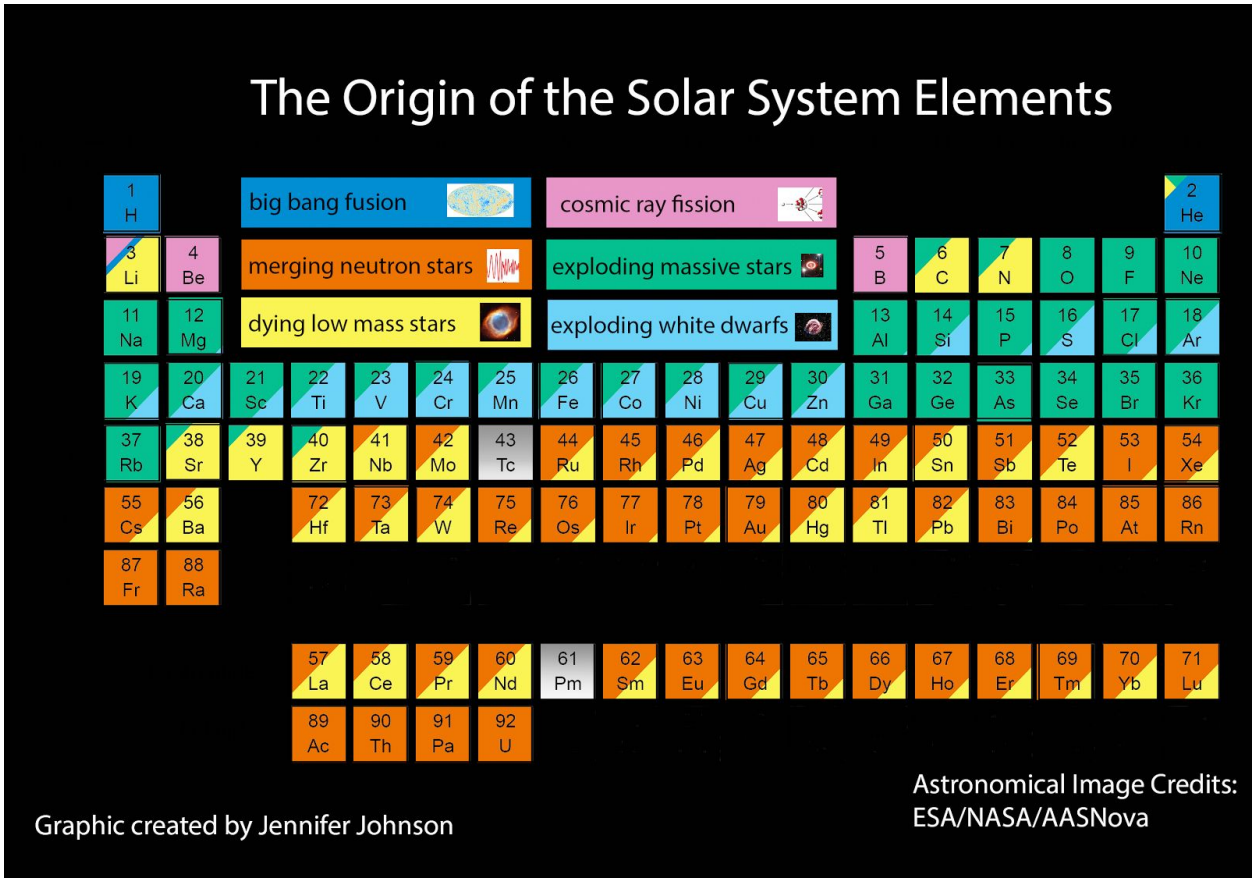


Color coding the table was vital in order for the user to have some visual understanding of the differences. The differences initially do not correlate with anything. But in other iterations we chose to make particular colors refer to being man made or created at the time of the big bang. Basically a color coded scale allowing the user to know what chemical is associated to which and thus they can relate that knowledge informatively when looking at the stars.

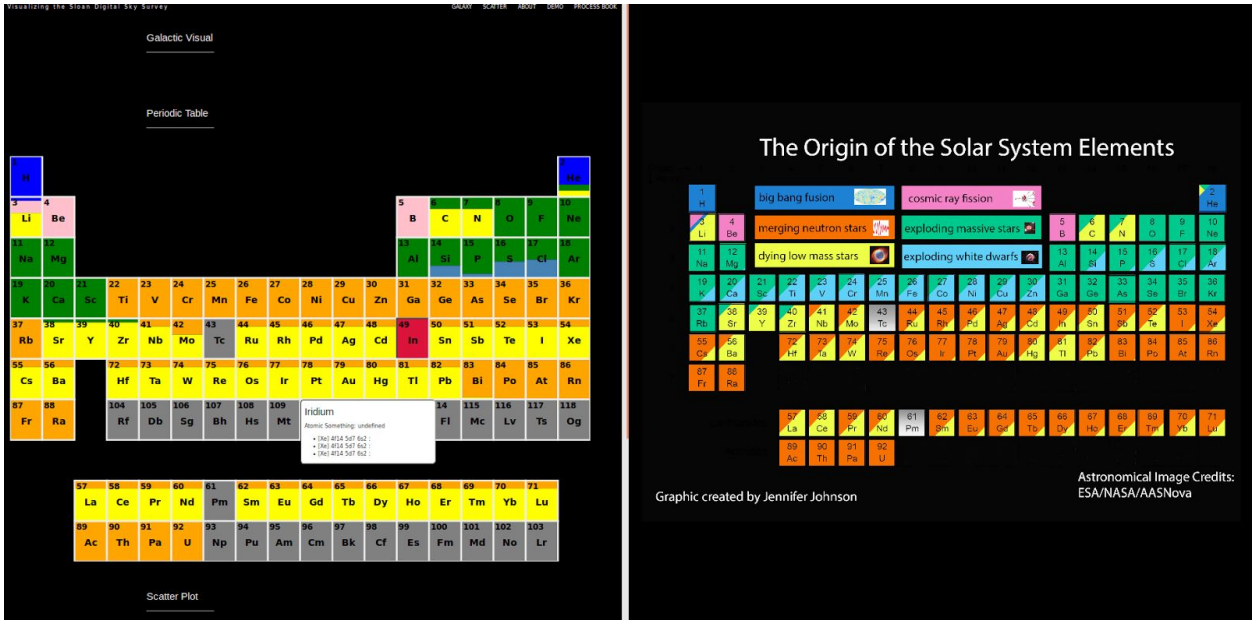


The addition of a few more chemicals was not as difficult as we originally thought. By adjusting the svg and the css we were able to and a column and row design below our initial periodic table and color code it using the same principles.




The Origin of the Solar System Elements
big bang fusion
cosmic ray fission
merging neutron stars
exploding massive stars
dying low mass stars
exploding white dwarfs
1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
57 La
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm
63 Eu
64 Gd
65 Tb
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
71 Lu
89 Ac
90 Th
91 Pa
92 U
Graphic created by Jennifer Johnson
Astronomical Image Credits:
ESA/NASA/AASNova

Below is a side by side representation of our merely finalized periodic table in comparison to a graphic we used as reference created by Jennifer Johnson. As you can see our coloring is a bit more custom pertaining to our specific liking and generates a tooltip as hovering over the element occurs with a mouse. We are quite pleased with what we have accomplished thus far.



Project Schedule-

We have delegated the responsibilities in a way that we believe play to our individual strengths. We will coordinate specific visualizations for the both of us to do and merge our work throughout the semester. Anthony will take on the majority of the d3/javascript challenges while Stefan will construct the HTML/CSS. Stefan will also primarily focus on the process book and project demo. We have coordinated weekly meeting times Tuesday and Thursday and personal goals for the project.

Weekly objectives:

10/30/17 -

Stefan: Create a rough draft boilerplate HTML/CSS document so we on begin working on inputting the visualizations.

Anthony: Created periodic table csv file with general info and added row and col attribute to be used in placement of tiles.

11/6/17 - Project Milestone Due 11/10/17

Stefan: Update the HTML/CSS for our prototype project with all d3 and javascript to generate beginning functionality. Finalize process book and peer evaluation for Friday milestone.

Anthony: Include some interactivity and d3 to the visualizations. Created the periodic table visualization. Discuss all visualizations with Stefan to finalize the beginning functionality view milestone.

11/13/17 -
Stefan: Continue to append to the process booklet while formatting the HTML/CSS and javascript in the correct format for the project design. Have an understanding of the final visuals needed including all the elements required.
Anthony: Continue working on the visualizations and interactivity for the periodic table, galactic visualization, and the scatter plot.

11/20/17 -
Stefan: Finalize the process booklet while formatting the HTML/CSS and javascript in the correct format for the project design.
Anthony: Finalize working on the visualizations and interactivity for the periodic table, galactic visualization, and the scatter plot.

11/27/17 - Final Project Due 12/1/17
Stefan: Wrap up the process book and create a demo video to embed on the webpage. Make sure embedded visuals are displaying well and nearing completion.
Anthony: Generate visualizations almost exactly to size and capability we need while adding the finishing touches.
12/4/17 -
Stefan: Finalize the process book, the demo video, complete a peer evaluation form, and do one final quality assurance check on the whole webpage.
Anthony: Finalize the visualizations, complete a peer evaluation form, and do a final quality assurance check on the whole webpage.

Evaluation-

Stefan: Thus far I think Anthony and I are a great match. We have effectively split our workload and we can focus on the project. We meet bi-weekly which always lets us catch up if we need to.
Anthony: Both of us want to make our project as good as it can be and that helps tremendously. Splitting the visualizations is crucial and trusting your teammate to complete certains aspects has not been a problem.