William Stein

January 12, 2015

Sage: create a viable free open source alternative to Magma, Maple, Matlab, and Mathematica

Sage: completely free and open source

Why?

- **Funding** from NSF, Microsoft, Google and donors
- **Volunteer contributions** from nearly 500 people over the last decade.

What?

- **Standalone** software solution: a web-based notebook, command-line, and Python library
- Comprised of about **100 (mathematical) software libraries**
- On top of that, the **Sage library** combines them and contains unique algorithms

The Sage/Python ecosystem

Status: awesome!

- Does much of what Magma, Maple, Matlab, and Mathematica does, but differently and better.
- Way ahead of Maple and Mathematica in combinatorics and number theory.
- Use any Python library inside of Sage – probably the most active programming language community on earth.
- Superb alternative to Matlab due to the massive **scientific Python** ecosystem.

The Sage/Python ecosystem

Status: fail

Failed so far at its mission statement to be a viable alternative to Ma*. For example:

> *I am very proud of my code for darmonpoints which does lots of things and is implemented in Sage. However, since it has Magma dependencies (mainly because of the lack of support of quaternion algebras in Sage) I have no plans to include it in Sage any time soon." - Marc Masdeau, Jan 10, 2015.*

NEW and Improving: Documentation

Many Tutorials

- The official Sage PREP tutorials, . . .

Very good introductory books about/using Sage

- Gregory Bard's new Sage for Undergraduates that AMS is publishing any day now, and the electronic book is **free**.

SageMathCloud

SageMathCloud (SMC)

SageMathCloud (SMC) – what it solves

SMC contribution:

You and all of your students and collaborators can now use Sage/IPython/LaTeX/R etc. together **without installing anything**

Acknowledgement

- **NSF/Google**-funded project over the last two years

What is SMC?

It's a large distributed system with **80 running VM's**

What you can do with SMC

- **Mathematics software:** Use Sage, R, Octave, Python, Cython, GAP, Pari, Macaulay2, Singular, and more
- **Teach:** Organize teaching a course
- **Interactive editing:** Collaboratively edit LaTeX documents, IPython notebooks, Textfiles and Sage worksheets
- **Programming:** Write, compile, and run code in C/C++, Java, Haskel, and most languages
- **Organize:** Manage TODO lists with hashtags
- **Backed up:** Every few minutes a consistent snapshot of all your files is sent to different data centers
- **Shell access:** Full Linux accounts copied with color terminals

SMC Users

Number of users

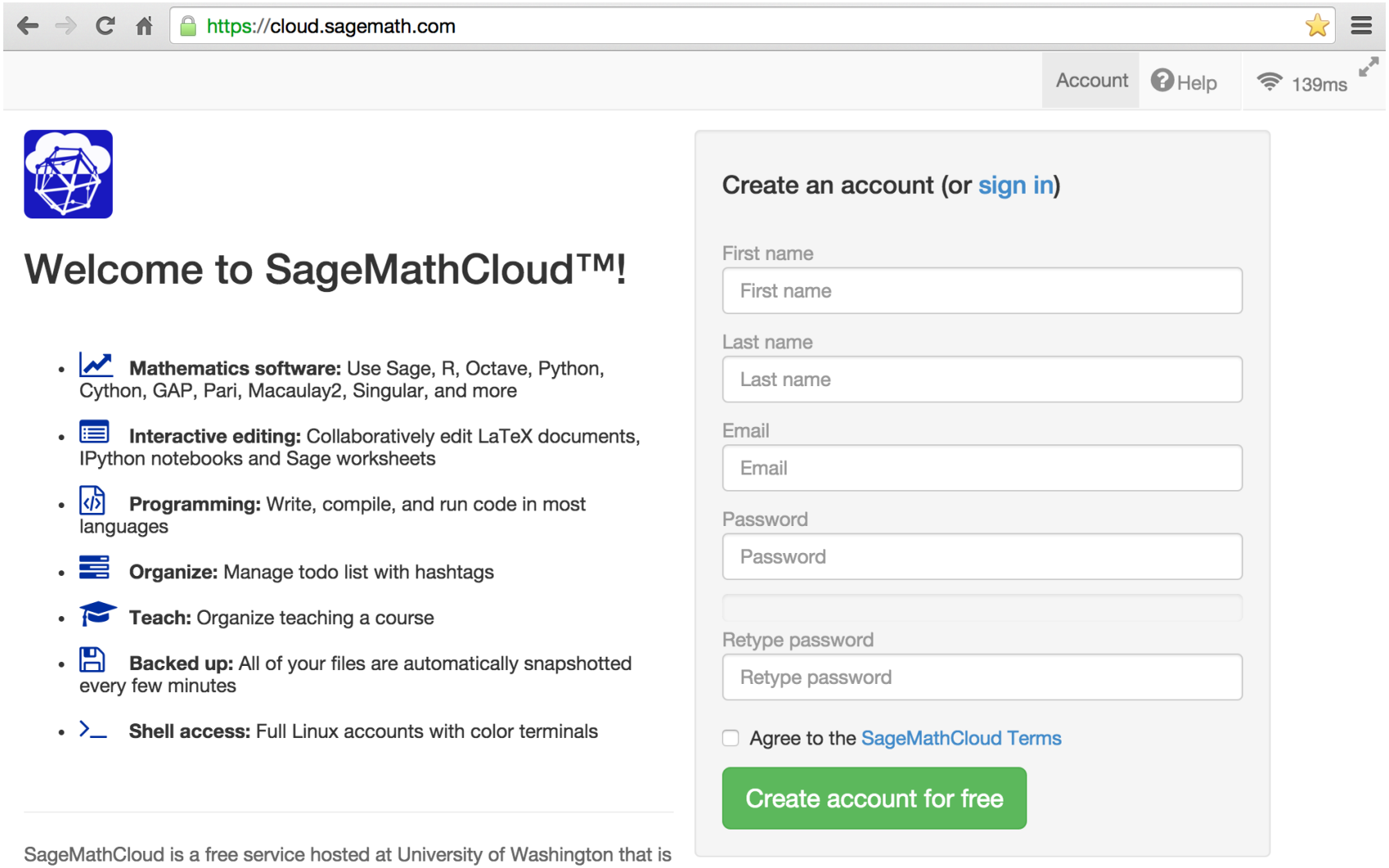
- **10K active weekly users**
- Over **500 simultaneous users** some days in December

Commercialization

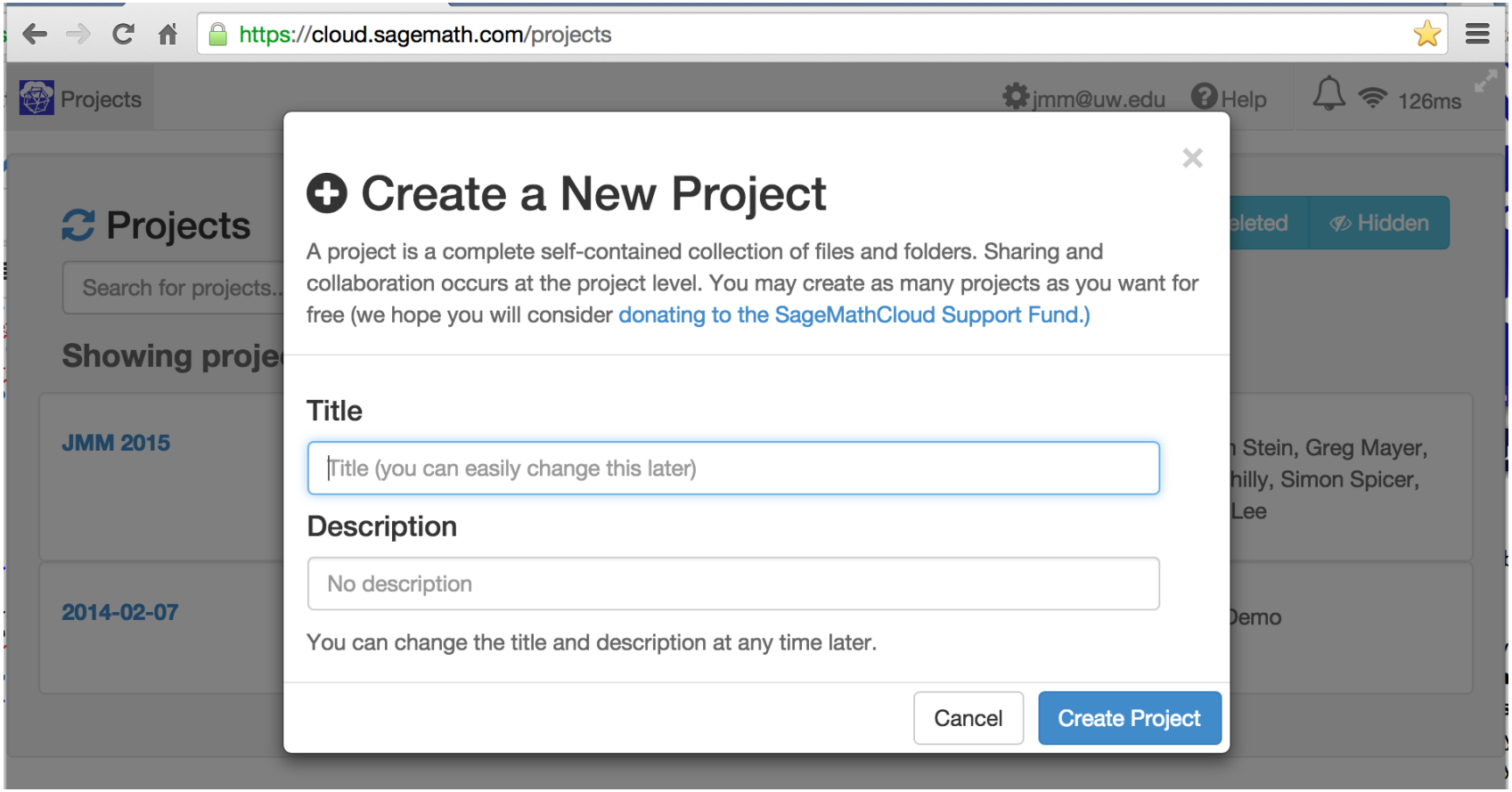
- Use of SMC website for courses will likely eventually involve paying a fee to support the site. **Sage will always be free.**
- **Will be affordable:** due to **efficiently leveraging** open source.

Tour

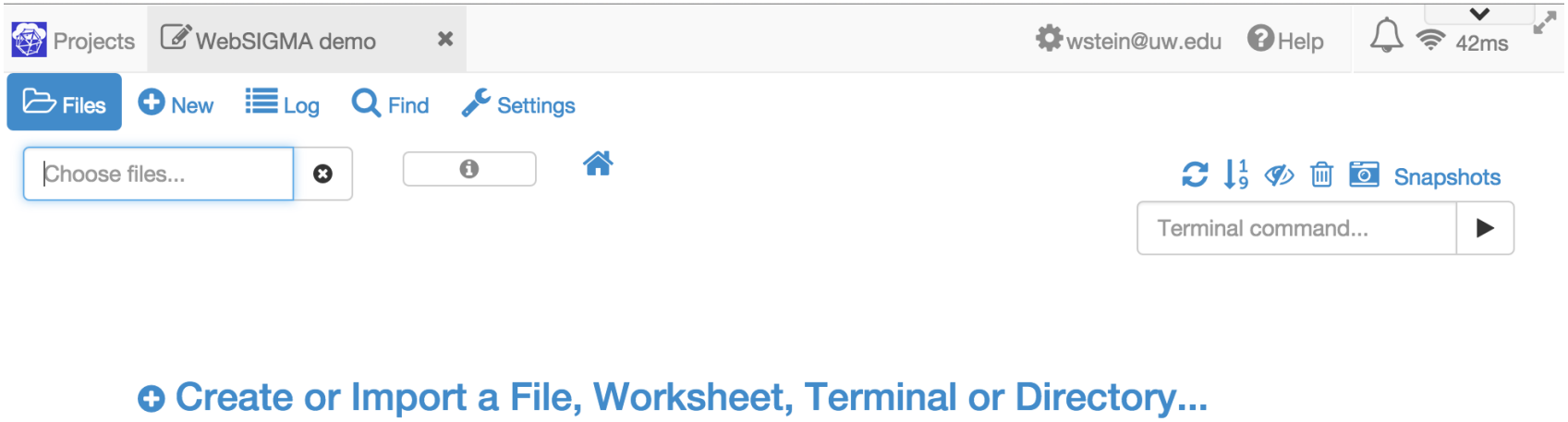
Make an SMC account



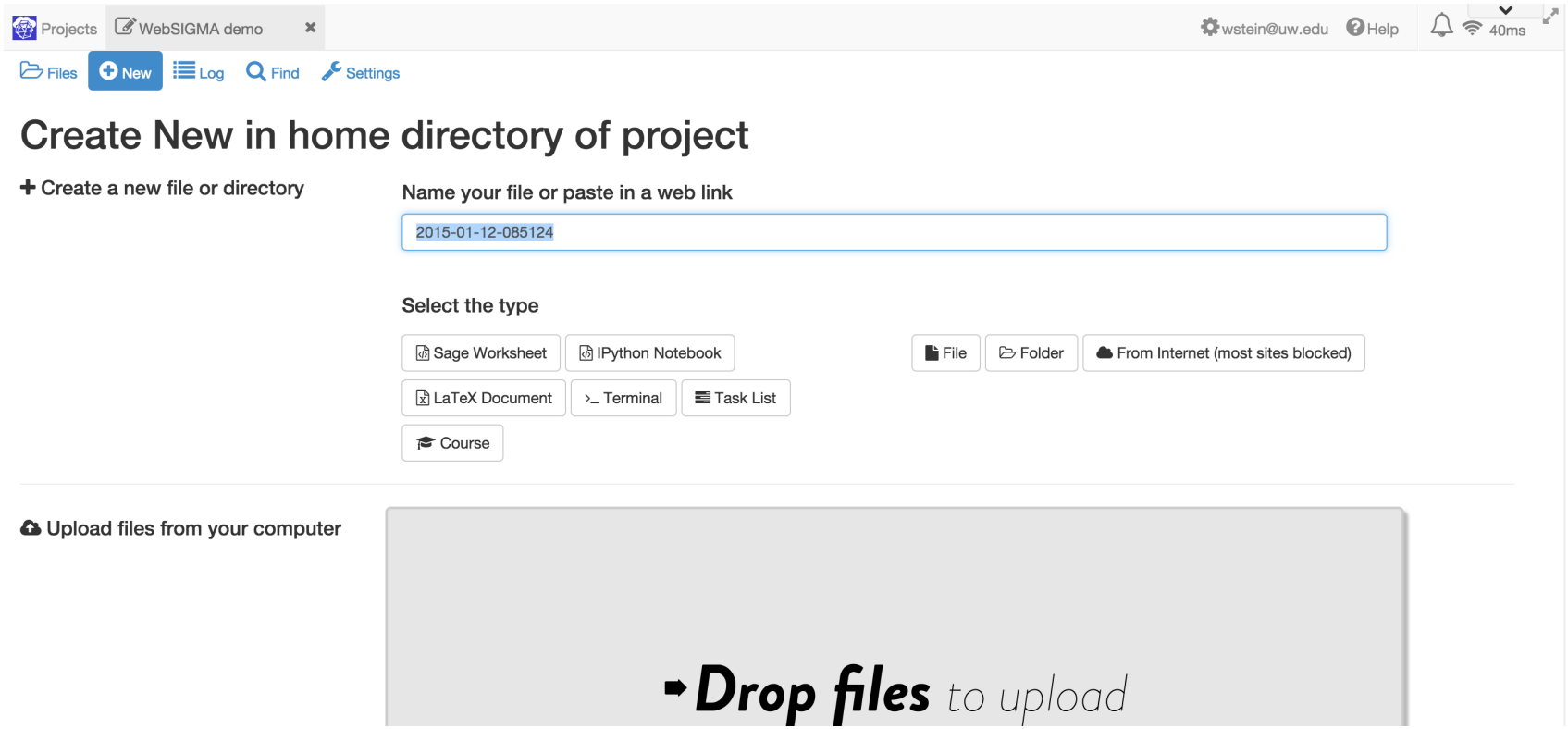
Create a project



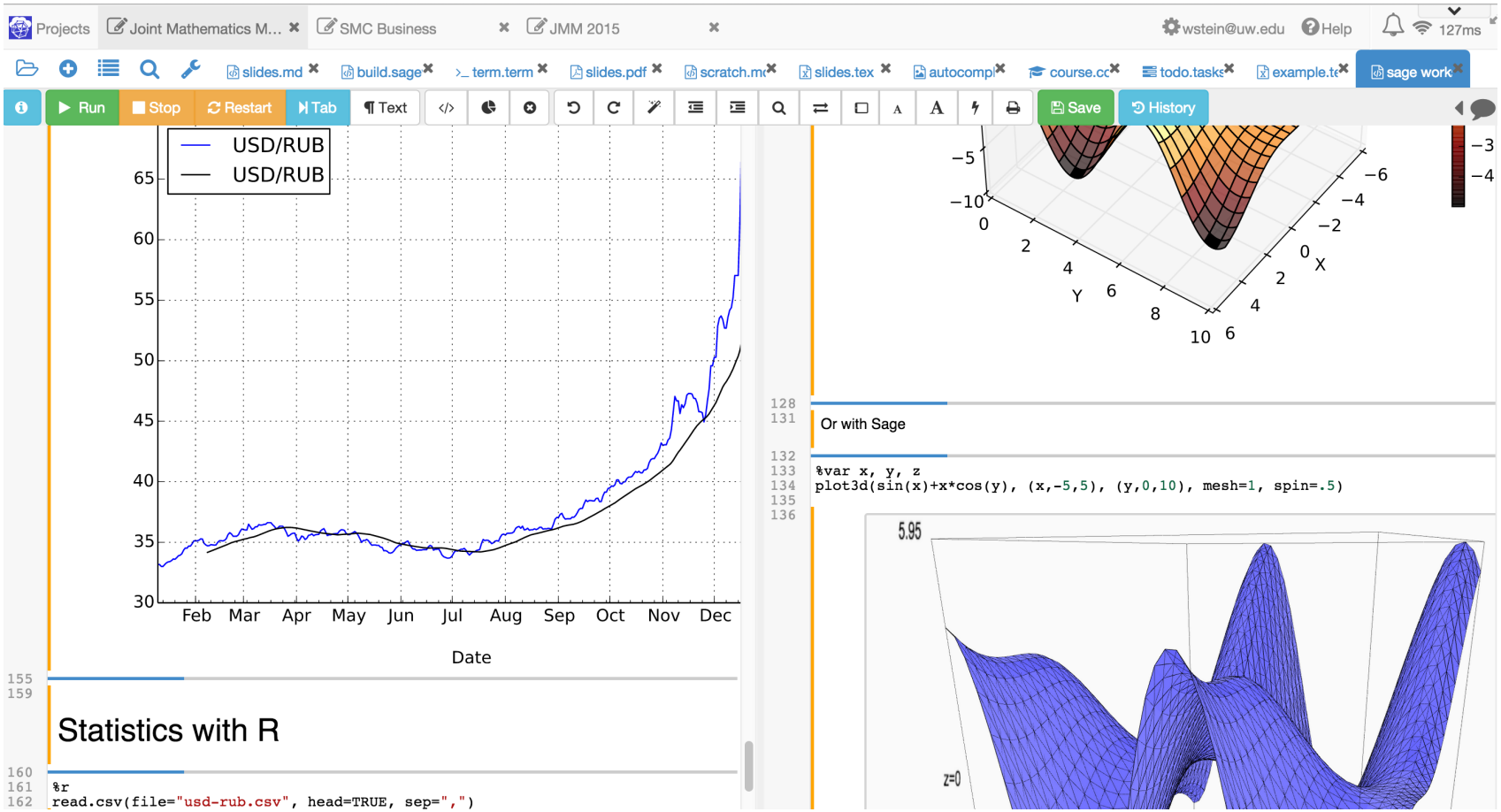
Open your new project



Add files


Projects
WebSIGMA demo
wstein@uw.edu
Help
40ms
Files
New
Log
Find
Settings
Create New in home directory of project
Create a new file or directory
Name your file or paste in a web link
2015-01-12-085124
Select the type
Sage Worksheet
IPython Notebook
File
Folder
From Internet (most sites blocked)
LaTeX Document
Terminal
Task List
Course
Upload files from your computer
Drop files to upload

Sage Worksheet



IPython Notebook

Projects | Joint Mathematics M... | SMC Business | JMM 2015 | wstein@uw.edu | Help | 123ms

slides.md | build.sagew | term.term | slides.pdf | scratch.md | slides.tex | autocomple | course.cou | ipython note

IP[y]: Notebook ipython notebook Last Checkpoint: Jan 12 09:44 (unsaved changes)

Save | Reload | Publish | About

File Edit View Insert Cell Kernel Help

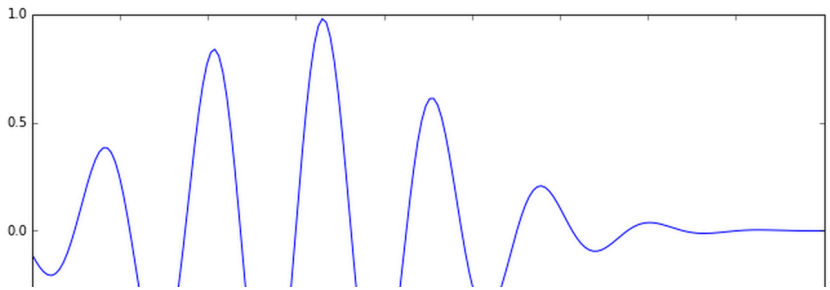
Markdown | Cell Toolbar: None

Full IPython Notebook

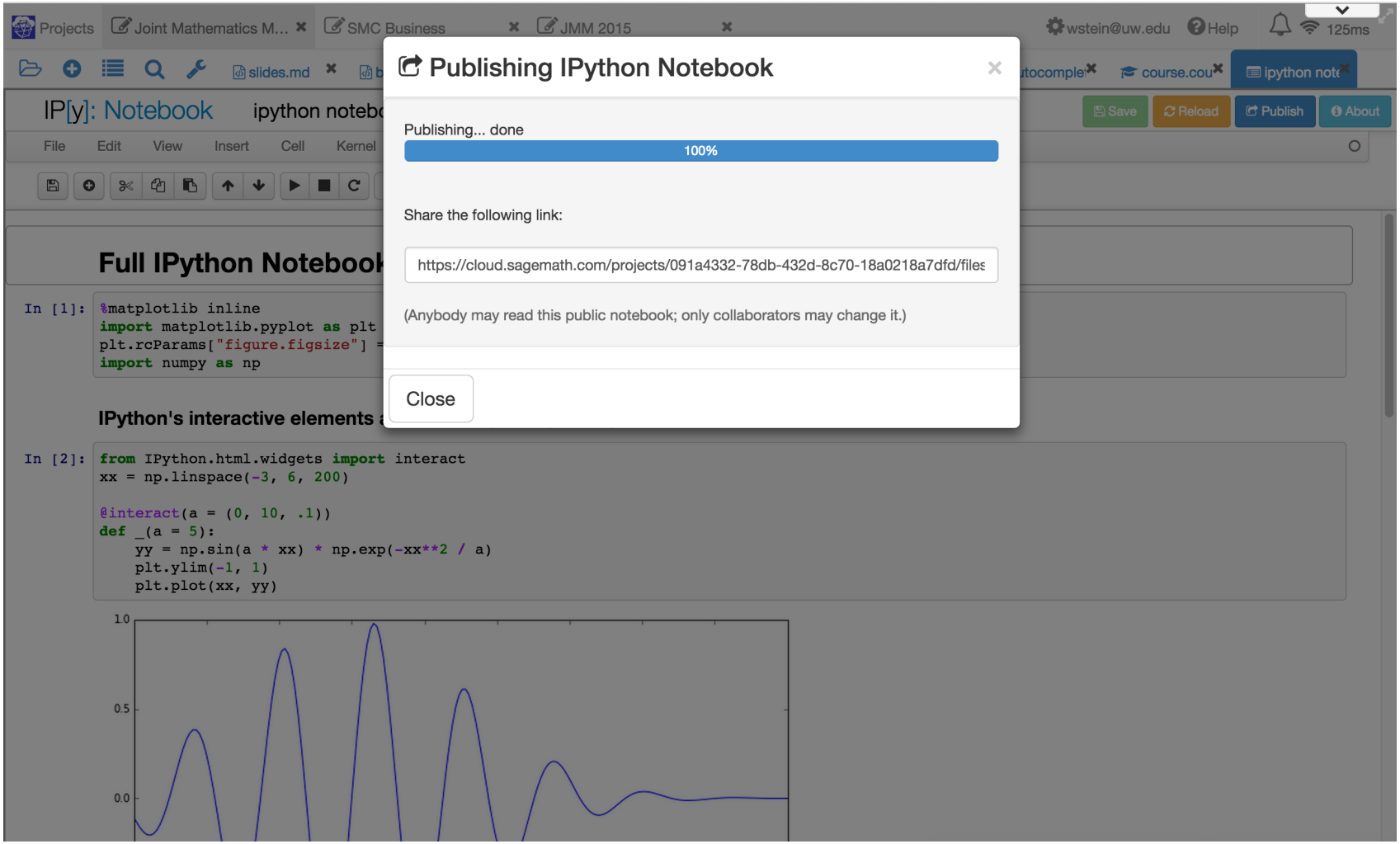
In [1]:
```
%matplotlib inline
import matplotlib.pyplot as plt
plt.rcParams["figure.figsize"] = (11, 6)
import numpy as np
```

IPython's interactive elements and a NumPy+Matplotlib plot

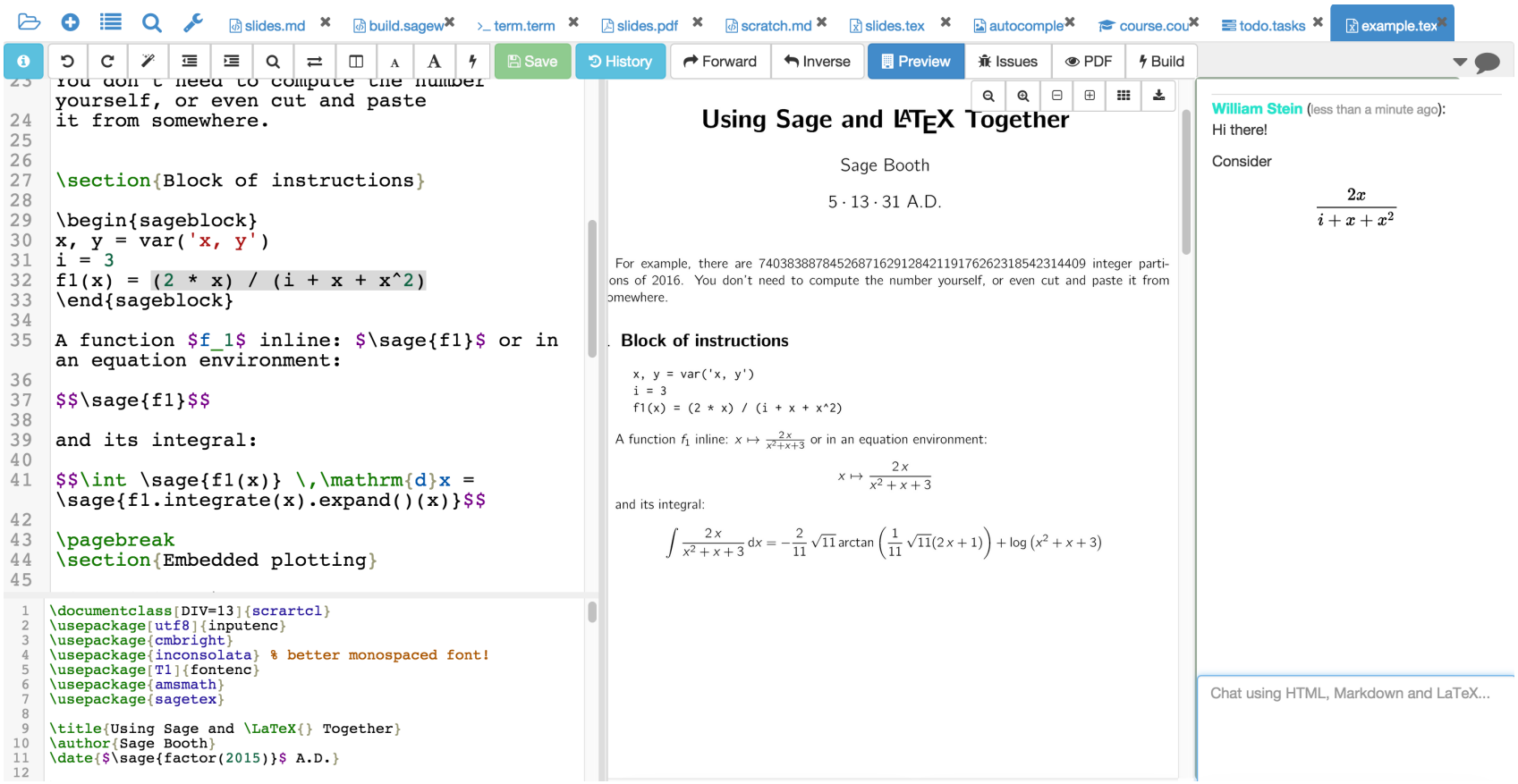
In [2]:
```
from IPython.html.widgets import interact
xx = np.linspace(-3, 6, 200)

@interact(a = (0, 10, .1))
def _(a = 5):
    yy = np.sin(a * xx) * np.exp(-xx**2 / a)
    plt.ylim(-1, 1)
    plt.plot(xx, yy)
```



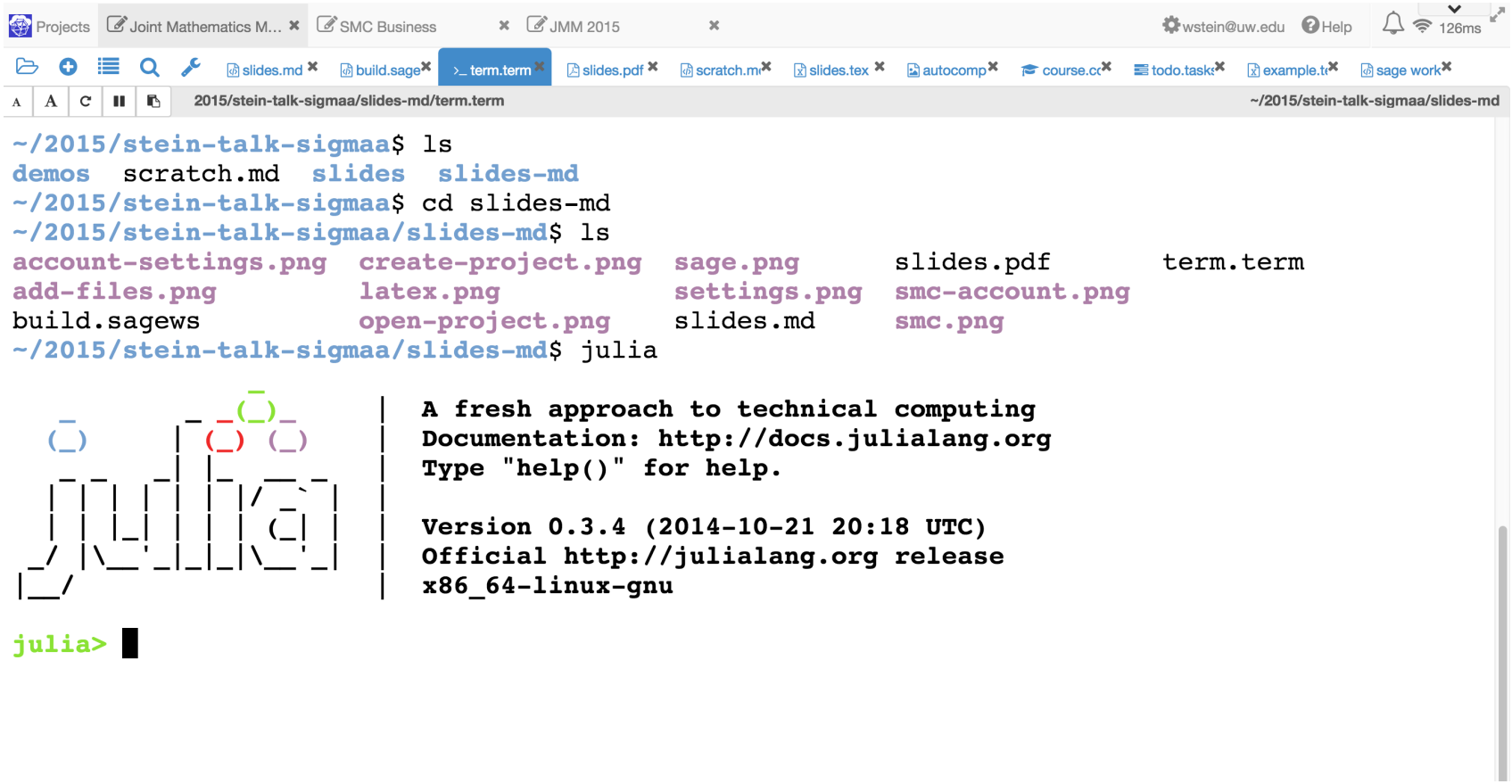
Publish your IPython Notebook



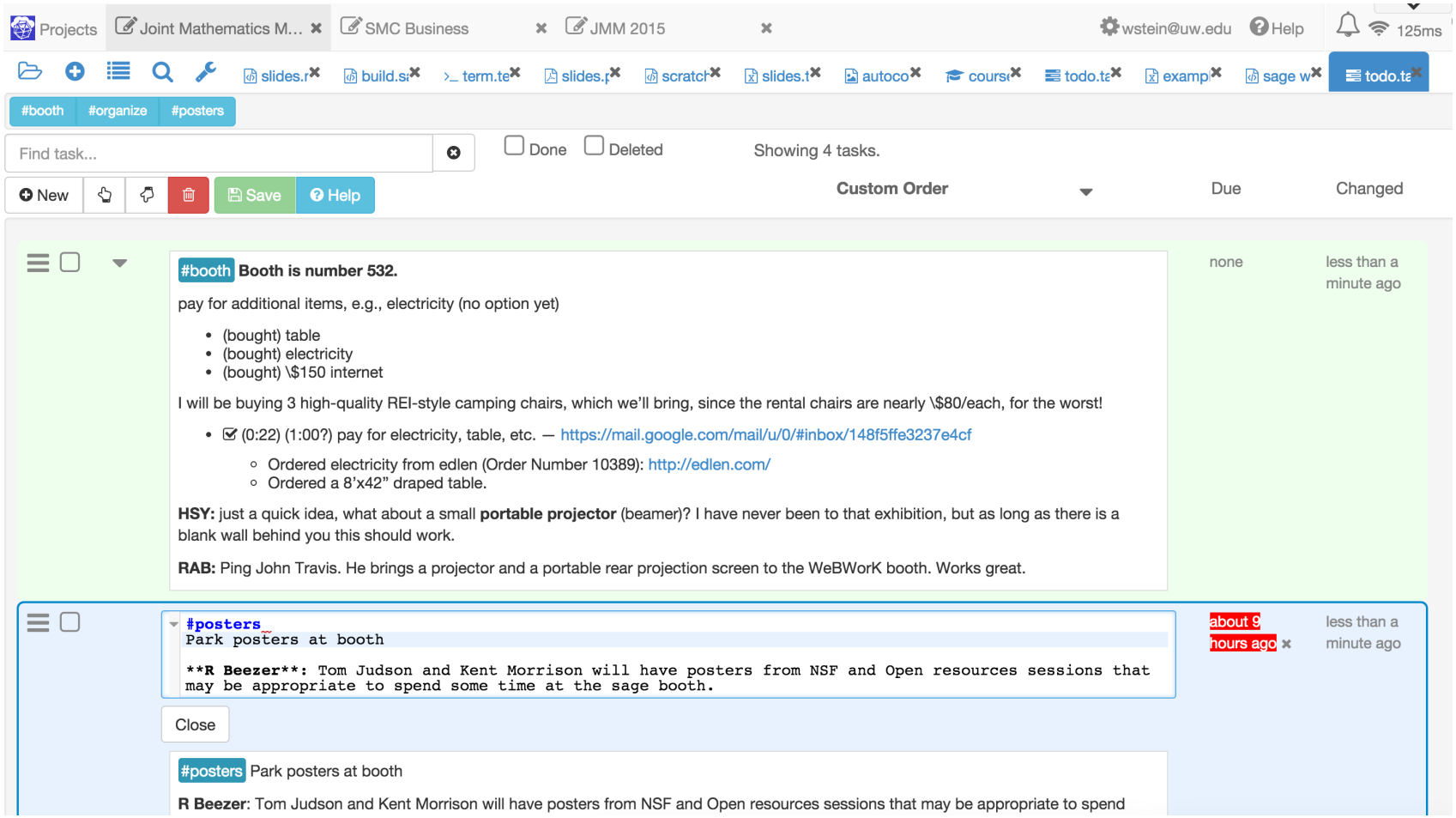
Latex Document



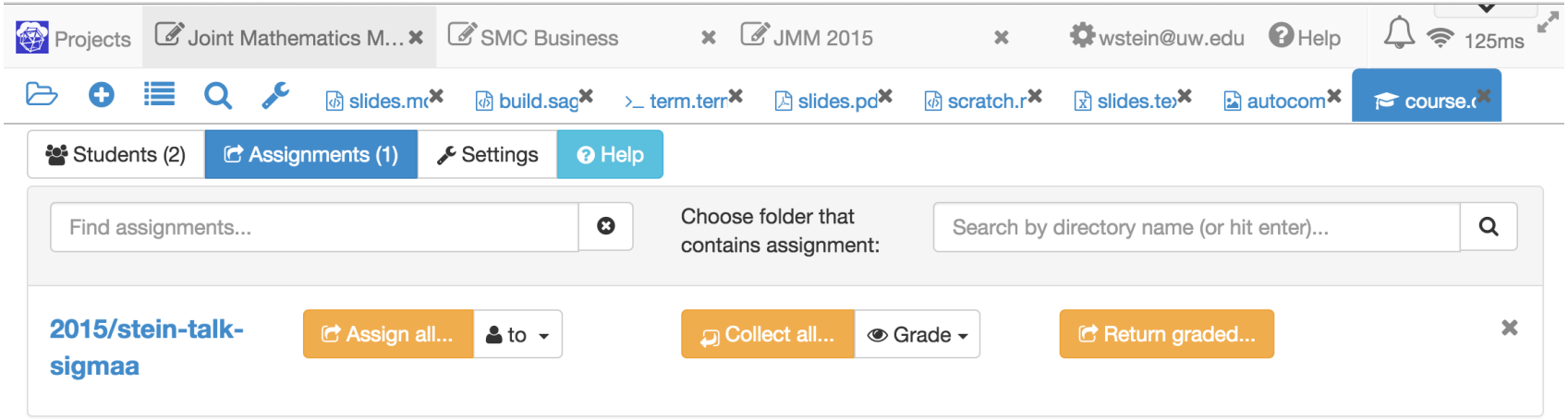
Terminal


Projects
Joint Mathematics M...
SMC Business
JMM 2015
wstein@uw.edu
Help
126ms
slides.md
build.sage
term.term
slides.pdf
scratch.m
slides.tex
autocomp
course.c
todo.task
example.t
sage work
2015/stein-talk-sigmaa/slides-md/term.term
~/2015/stein-talk-sigmaa/slides-md
~/2015/stein-talk-sigmaa$ ls
demos scratch.md slides slides-md
~/2015/stein-talk-sigmaa$ cd slides-md
~/2015/stein-talk-sigmaa/slides-md$ ls
account-settings.png create-project.png sage.png slides.pdf term.term
add-files.png latex.png settings.png smc-account.png
build.sagews open-project.png slides.md smc.png
~/2015/stein-talk-sigmaa/slides-md$ julia
A fresh approach to technical computing
Documentation: http://docs.julialang.org
Type "help()" for help.
Version 0.3.4 (2014-10-21 20:18 UTC)
Official http://julialang.org release
x86_64-linux-gnu
julia>

Task List


Projects
Joint Mathematics M...
SMC Business
JMM 2015
wstein@uw.edu
Help
125ms
#booth
#organize
#posters
Find task...
Done
Deleted
Showing 4 tasks.
New
Save
Help
Custom Order
Due
Changed
#booth Booth is number 532.
pay for additional items, e.g., electricity (no option yet)
(bought) table
(bought) electricity
(bought) \$150 internet
I will be buying 3 high-quality REI-style camping chairs, which we'll bring, since the rental chairs are nearly \$80/each, for the worst!
(0:22) (1:00?) pay for electricity, table, etc. — https://mail.google.com/mail/u/0/#inbox/148f5ffe3237e4cf
Ordered electricity from edlen (Order Number 10389): http://edlen.com/
Ordered a 8'x42" draped table.
HSY: just a quick idea, what about a small portable projector (beamer)? I have never been to that exhibition, but as long as there is a blank wall behind you this should work.
RAB: Ping John Travis. He brings a projector and a portable rear projection screen to the WeBWorK booth. Works great.
none
less than a minute ago
#posters
Park posters at booth
R Beezer: Tom Judson and Kent Morrison will have posters from NSF and Open resources sessions that may be appropriate to spend some time at the sage booth.
about 9 hours ago
less than a minute ago
Close
#posters Park posters at booth
R Beezer: Tom Judson and Kent Morrison will have posters from NSF and Open resources sessions that may be appropriate to spend

Course


Projects
Joint Mathematics M...
SMC Business
JMM 2015
wstein@uw.edu
Help
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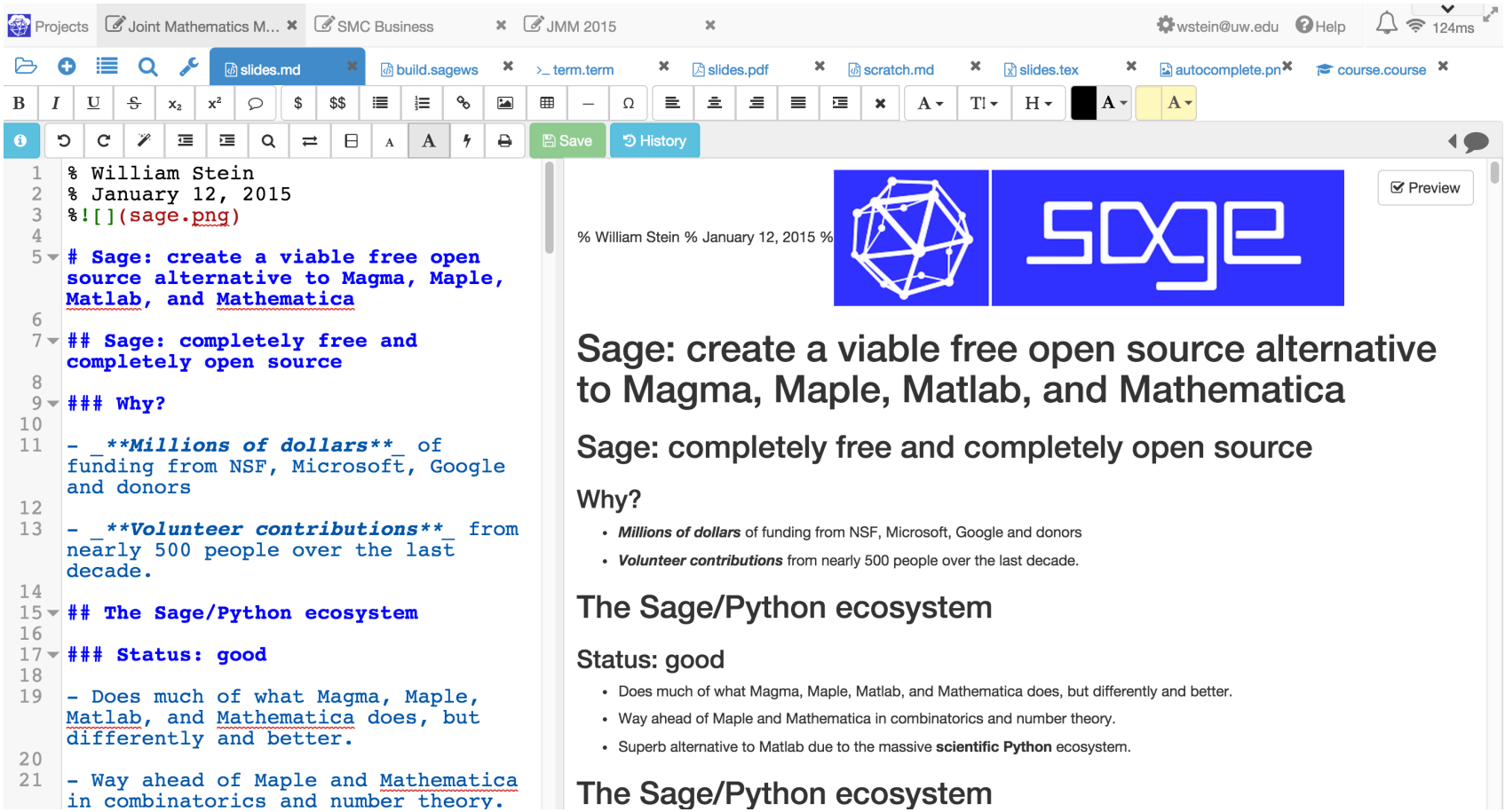
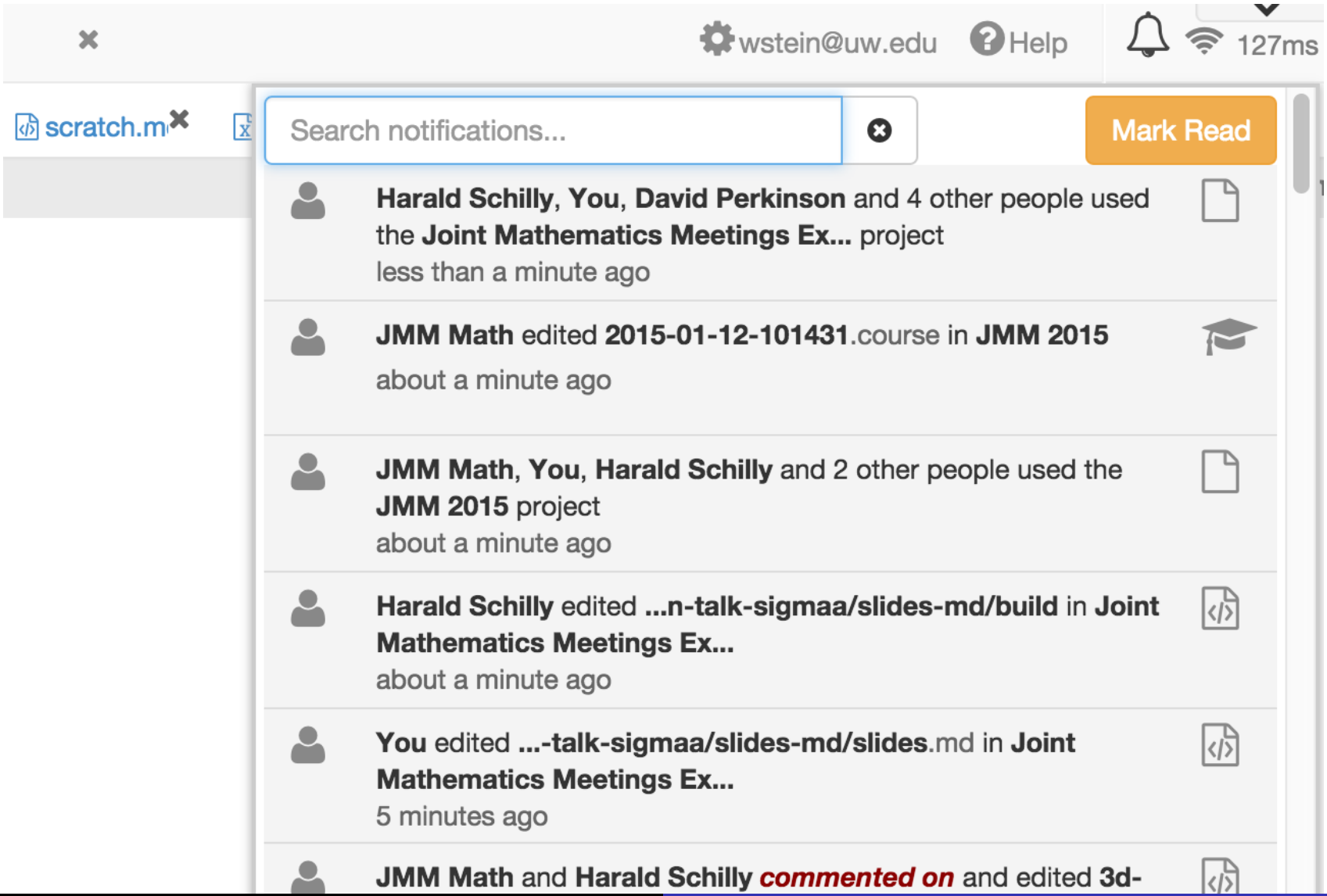
term.terr
slides.pd
scratch.r
slides.te
autocom
course.
Students (2)
Assignments (1)
Settings
Help
Find assignments...
Choose folder that contains assignment:
Search by directory name (or hit enter)...
2015/stein-talk-sigmaa
Assign all...
to
Collect all...
Grade
Return graded...

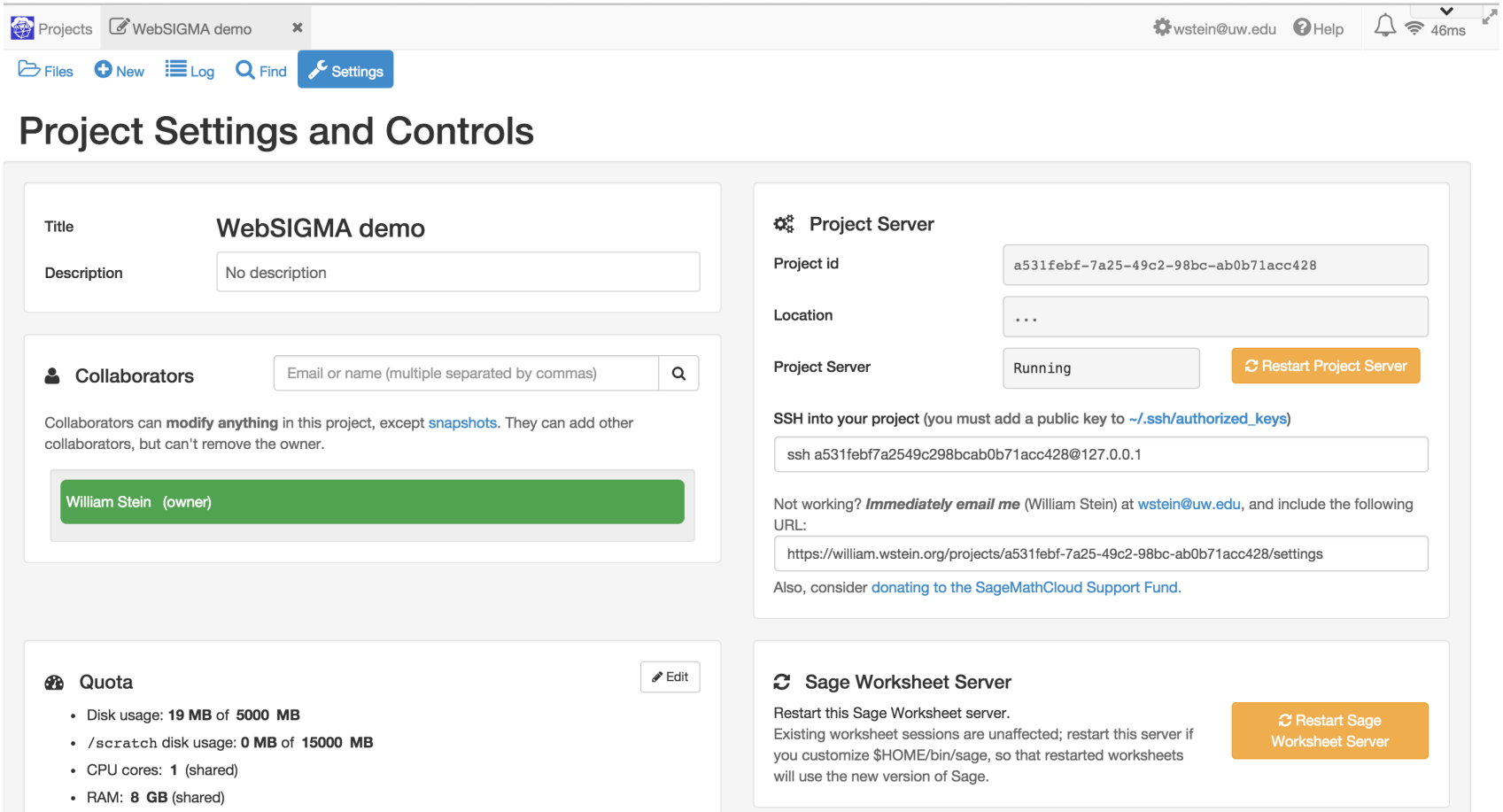
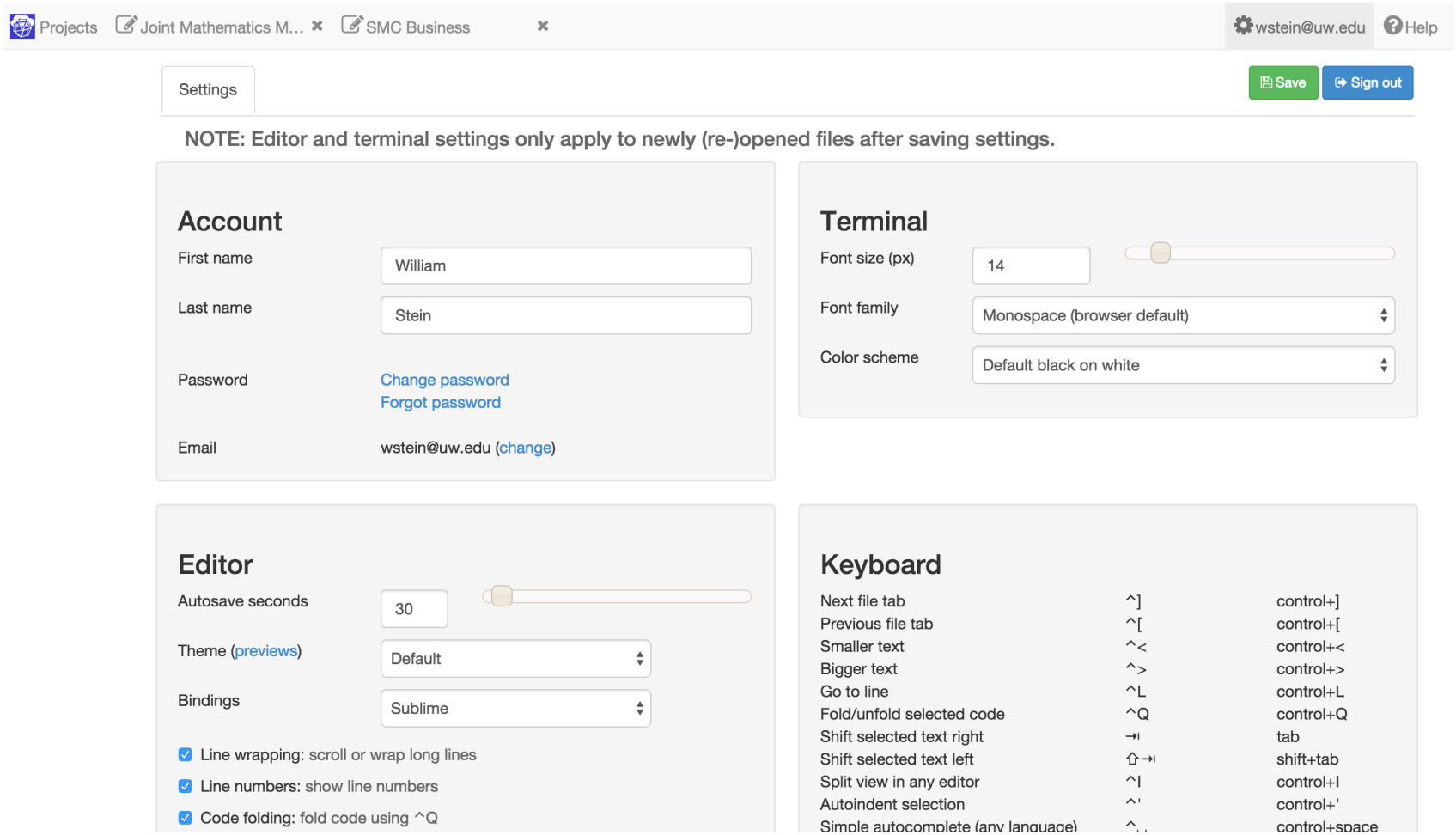
Markdown files



Notification feed



Project settings



Also, account settings