



A Walk Through Python Ecosystem

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ASTRON



Python

Centrum Wiskunde and Informatica (CWI, University of Amsterdam)

Guido van Rossum, 1989

hobby' programming project in the week around Christmas

Python in No.1 slot - *IEEE Spectrum, July 2017*

High-level, multi-programming paradigm (Meta, generic, object oriented etc.)
and **versatile** language

```
>>> import this  
The Zen of Python, by Tim Peters
```

Beautiful is better than ugly.
Explicit is better than implicit.
Simple is better than complex.
Complex is better than complicated.
Flat is better than nested.
Sparse is better than dense.
Readability counts.
Special cases aren't special enough to break the rules.
Although practicality beats purity.
Errors should never pass silently.
Unless explicitly silenced.
In the face of ambiguity, refuse the temptation to guess.
There should be one-- and preferably only one --obvious way to do it.
Although that way may not be obvious at first unless you're Dutch.
Now is better than never.
Although never is often better than ~~right~~ now.
If the implementation is hard to explain, it's a bad idea.
If the implementation is easy to explain, it may be a good idea.
Namespaces are one honking great idea -- let's do more of those!

Key advantages

- Simplicity, natural flow
- Dynamic typing in combination with static
- Extensive, powerful standard library
 - See Awesome-Python to get a feeling for module usage
- Python wall of Superpowers - Py 3.0
- Launchpad, GitHub, BitBucket
- PyPI - the Python Package Index lists **134290** packages

PyPI

Find, install and publish Python packages
with the Python Package Index

Search Projects 

Or [browse projects.](#)

134,290 Projects 931,267 Releases 1,237,854 Files 272,148 Users

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10 projects with the selected classifiers Order by Relevance

▼ ENVIRONMENT :: MACOS X ✕ ▼ INTENDED AUDIENCE :: SCIENCE/RESEARCH ✕ ▼ TOPIC :: EDUCATION ✕

alvi 1.1.1
Algorithm Visualization framework

Gato 1.2.2
Graph Animation Toolbox: animating algorithms on graphs

macss_tallies 0.0.5

o 0.11
ame latin-hypercube-sampling-based Monte Carlo Error Propagation

Install* a package
(pip**, easy_install,
source files)
- - user



Add to python path



Check and
import packages

*Packages containing C/C++ python-dev-all

**Pip needs to be installed

Python Packages or Modules

- Python has the **built-in** scopes - functions and classes such as len, str etc.
- **LEBG rule** - Local, enclosed, built-in, global
- Python **module** - can be a single file containing a function or a collection of such files
- Python **package** - Directory containing various such modules

Install* a package
(pip**, easy_install,
source files)
-- user



Add to python path



Check and
import packages

```
MacJaodand:~ jaodand$ python
Python 2.7.13 |Anaconda custom (x86_64)| (default, Dec 20 2016, 23:05:08)
[GCC 4.2.1 Compatible Apple LLVM 6.0 (clang-600.0.57)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
Anaconda is brought to you by Continuum Analytics.
Please check out: http://continuum.io/thanks and https://anaconda.org
>>> import sys
>>> print(sys.path)
['', '/Users/jaodand/anaconda/lib/python27.zip', '/Users/jaodand/anaconda/lib/python2.7', '/Users/jaodand/anaconda/lib/python2.7/plat-darwin', '/Users/jaodand/anaconda/lib/python2.7/plat-mac/lib-scriptpackages', '/Users/jaodand/anaconda/lib/python2.7/lib-tk', '/Users/jaodand/anaconda/lib/python2.7/lib-dynload', '/Users/jaodand/anaconda/lib/python2.7/site-packages', '/Users/jaodand/anaconda/lib/python2.7/site-packages/PIL', '/Users/jaodand/anaconda/lib/python2.7/site-packages/DateTime-4.2-py2.7.egg', '/Users/jaodand/anaconda/lib/python2.7/site-packages/zope.interface-4.3.1-py2.7.egg', '/Users/jaodand/anaconda/lib/python2.7/site-packages/setuptools-27.2.0-py2.7.egg', '/Users/jaodand/anaconda/lib/python2.7/site-packages/runipy-0.1.1-py2.7.egg']
>>>
```

```
MacJaodand:~ jaodand$ export PYTHONPATH=$PYTHONPATH:/path/to/some/directory      # Append
MacJaodand:~ jaodand$ export PYTHONPATH=/path/to/some/directory:$PYTHONPATH      # Prepend
```

*Packages containing C/C++ python-dev-all

**Pip needs to be installed

Python in Astronomy

- Open-source
- Vast developing community
- Mature scientific libraries
- Choose your interpreter - Cython, Jython etc.

Practical Python for Astronomers

<http://python4astronomers.github.io/>

Authors: Tom Aldcroft, **Tom Robitaille**, Brian Refsdal, Gus Muench

Copyright: 2011, 2012, 2013 Smithsonian Astrophysical Observatory

Other online resources: Coursera, Python in Astronomy workshops

Key Astro packages

IPython

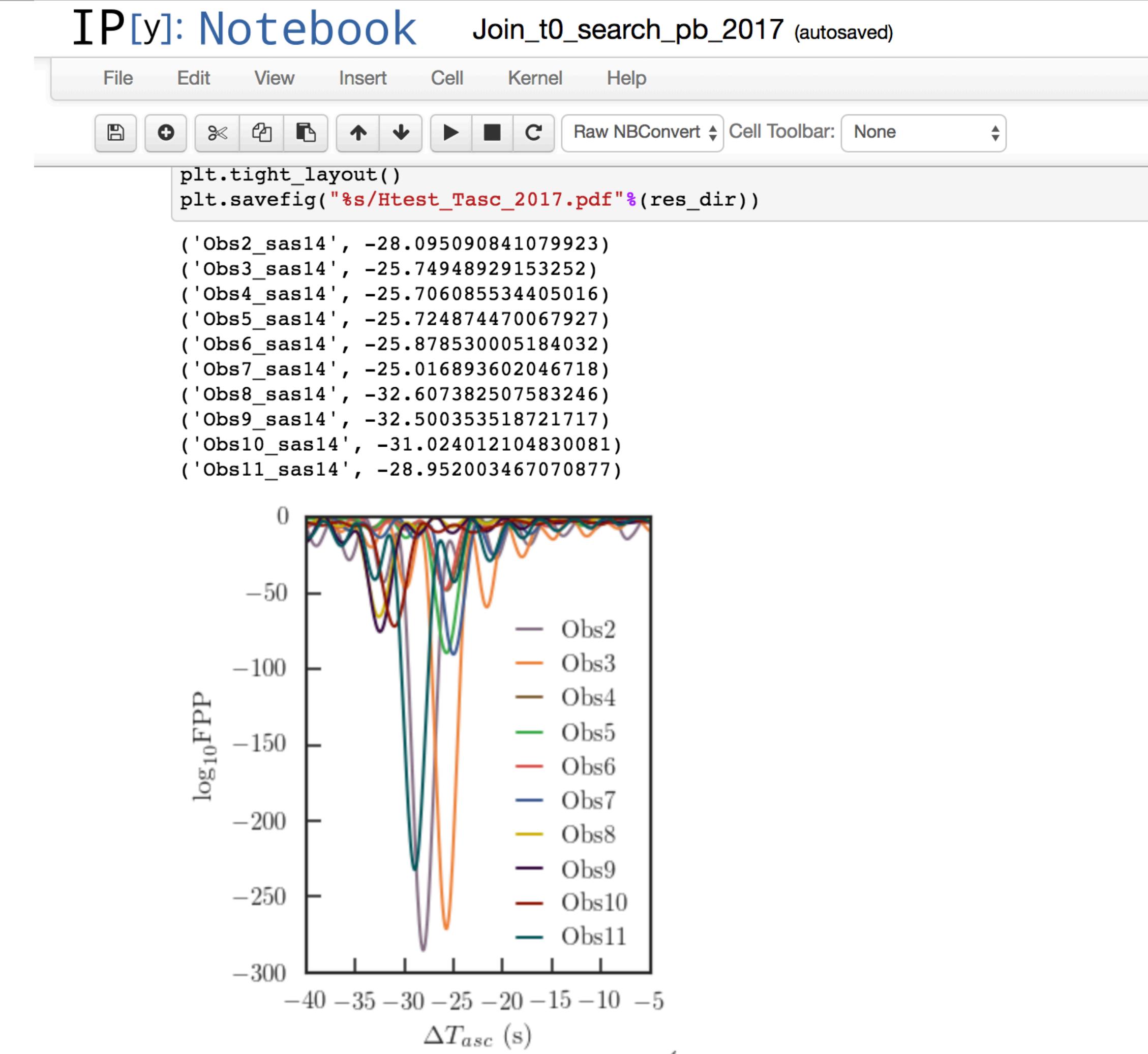
<https://ipython.org/>

Powerful instructive shell

Exploratory

Interactive data visualisation

Current versions: March 2018 - **IPython 5.6 and 6.3**



SciPy



<https://www.scipy.org/>

Pronounced ‘sigh-pie’

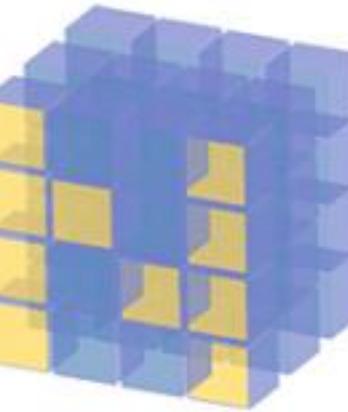
Powerful packages containing several critical modules such as integration, optimisation, statistics tools

Very well-maintained documentation for both developers and users.

<http://scipy.github.io/devdocs/hacking.html>

```
scipy.cluster
scipy.cluster.hierarchy
scipy.cluster.vq
scipy.constants
scipy.fftpack
scipy.fftpack.convolve
scipy.integrate
scipy.interpolate
scipy.io
scipy.io.arff
scipy.io.netcdf
scipy.io.wavfile
scipy.linalg
scipy.linalg.blas
scipy.linalg.cython_blas
scipy.linalg.cython_lapack
scipy.linalg.interpolative
scipy.linalg.lapack
scipy.misc
scipy.ndimage
scipy.odr
scipy.optimize
scipy.optimize.nonlin
scipy.signal
scipy.signal.windows
scipy.sparse
scipy.sparse.csgraph
scipy.sparse.linalg
scipy.spatial
>>> import pkgutil
>>> import scipy
>>> package=scipy
>>> for importer, modname, ispkg in pkgutil.walk_packages(path=package.__path__,
...                                         prefix=package.__name__+'.',
...                                         onerror=lambda x: None):
...     ...
...     print(modname)
...
scipy.__config__
scipy._build_utils
scipy._build_utils._fortran
scipy._lib
scipy._lib._ccallback
scipy._lib._ccallback_c
scipy._lib._gcutils
scipy._lib._numpy_compat
scipy._lib._test_ccallback
scipy._lib._testutils
scipy._lib._threadsafety
scipy._lib._tmpdirs
scipy._lib._util
scipy._lib._version
scipy._lib.decorator
scipy._lib.setup
scipy._lib.six
scipy.cluster
scipy.cluster._hierarchy
scipy.cluster._vq
scipy.cluster.hierarchy
scipy.cluster.setup
scipy.cluster.vq
scipy.constants
scipy.constants.codata
scipy.constants.constants
scipy.constants.setup
scipy.fftpack
scipy.fftpack._fftpack
scipy.fftpack.basic
scipy.fftpack.convolve
scipy.fftpack.fftpack_version
scipy.fftpack.helper
scipy.fftpack.pseudo_diffs
scipy.fftpack.realtransforms
scipy.fftpack.setup
scipy.integrate
scipy.integrate._bvp
```

NumPy



<https://www.numpy.org/>

N-dimensional array object

Broadcasting Functions

Generic Data container

Useful capabilities such as linear algebra,

Fourier transform etc.

```
>>> package=numpy
>>> for importer, modname, ispkg in pkgutil.walk_packages(path=package.__path__,
...                                         prefix=package.__name__+'.',
...                                         onerror=lambda x: None):
...     print(modname)
...
numpy.__config__
numpy._globals
numpy._import_tools
numpy.add_newdocs
numpy.compat
numpy.compat._inspect
numpy.compat.py3k
numpy.compat.setup
numpy.core
numpy.core._dummy
numpy.core._internal
numpy.core._methods
numpy.core.arrayprint
numpy.core.cversions
numpy.core.defchararray
numpy.core.fromnumeric
numpy.core.function_base
numpy.core.generate_numpy_api
numpy.core.getlimits
numpy.core.info
numpy.core.machar
numpy.core.memmap
numpy.core.multiarray
numpy.core.multiarray_tests
numpy.core.numeric
numpy.core.numerictypes
numpy.core.operand_flag_tests
numpy.core.records
numpy.core.setup
numpy.core.setup_common
numpy.core.shape_base
numpy.core.struct_ufunc_test
numpy.core.test_rational
numpy.core.umath
numpy.core.umath_tests
numpy.ctypeslib
numpy.distutils
numpy.distutils.__config__
numpy.distutils.__version__
numpy.distutils.ccompiler
numpy.distutils.command
numpy.distutils.command.autodist
numpy.distutils.command.bdist_rpm
numpy.distutils.command.build
numpy.distutils.command.build_clib
numpy.distutils.command.build_ext
numpy.distutils.command.build_py
```

List of other important packages

1

Astropy

See talk by B. Sipocz

2

Pandas

<https://pandas.pydata.org/>

3

Seaborn

<https://seaborn.pydata.org/>

4

astroML

<http://www.astroml.org/>

5

Matplotlib

<https://matplotlib.org/>

6

TensorFlow

<https://www.tensorflow.org/>

Python 3.0



Not backwards compatible with 2.0

<http://python3wos.appspot.com/> - Python wall of Shame!



New tools such as 2to3

Fixer code



Print is now a function!

Text Vs. Data Instead Of Unicode Vs. 8-bit¶



Documentation about what's new in Python 3.0

<https://docs.python.org/3/whatsnew/3.0.html>

Summary

Lots of great modules

**Opportunities to learn and contribute as
developers: PyCon, Python in Astronomy
and PyLadies**

Submit and license your code

Keep exploring!!

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