


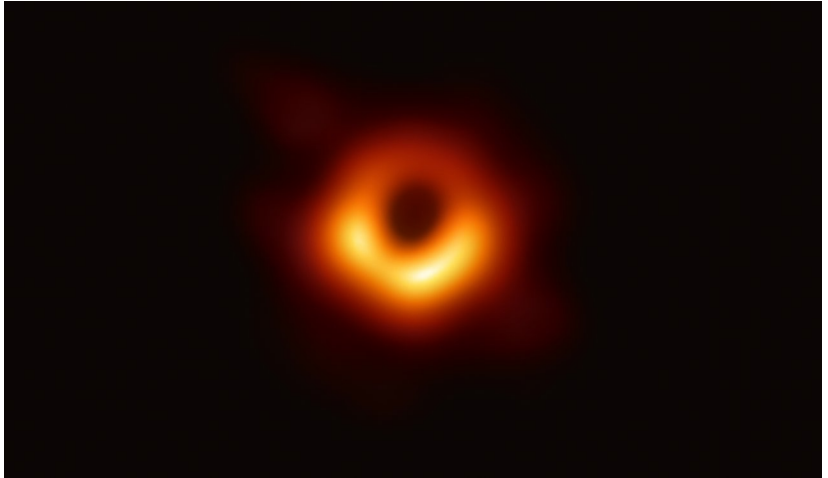
Introduction to SciPy

Gert-Ludwig Ingold

 <https://github.com/gertingold/euroscipy-scipy-tutorial.git>

Event Horizon Telescope

supermassive black hole in M87



credit: EHT Collaboration

Event Horizon Telescope

THE ASTROPHYSICAL JOURNAL LETTERS, 875:L3 (32pp), 2019 April 10

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<https://doi.org/10.3847/2041-8213/ab0c57>



First M87 Event Horizon Telescope Results. III. Data Processing and Calibration

The Event Horizon Telescope Collaboration
(See the end matter for the full list of authors.)

Received 2019 February 11; revised 2019 March 3; accepted 2019 March 3; published 2019 April 10

Abstract

We present the calibration and reduction of Event Horizon Telescope (EHT) 1.3 mm radio wavelength observations of the supermassive black hole candidate at the center of the radio galaxy M87 and the quasar 3C 279, taken during the 2017 April 5–11 observing campaign. These global very long baseline interferometric

we thank for EHT-specific support with the use of DiFX. We acknowledge the significance that Maunakea, where the SMA and JCMT EHT stations are located, has for the indigenous Hawaiian people.

Facilities: EHT, ALMA, APEX, IRAM:30 m, JCMT, LMT, SMA, ARO:SMT, SPT.

Software: DiFX (Deller et al. 2011), CALC, PolConvert (Martí-Vidal et al. 2016), HOPS (Whitney et al. 2004), CASA (McMullin et al. 2007), AIPS (Greisen 2003), ParselTongue (Kettenis et al. 2006), GNU Parallel (Tange 2011), GILDAS, eht-imaging (Chael et al. 2016, 2018), Numpy (van der Walt

et al. 2011), Scipy (Jones et al. 2001), Pandas (McKinney 2010), Astropy (The Astropy Collaboration et al. 2013, 2018), Jupyter (Kluyver et al. 2016), Matplotlib (Hunter 2007).

Appendix Site and Data Issues

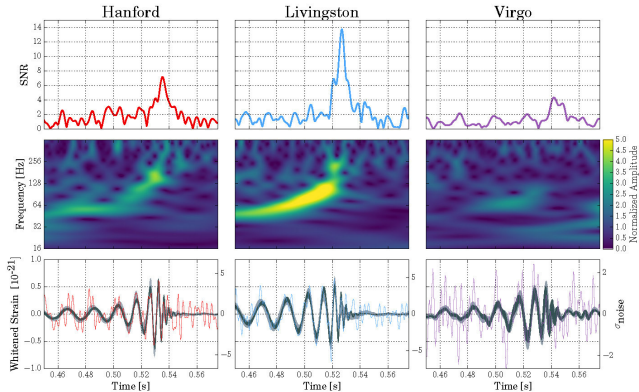
A.1. Issues Requiring Mitigation

The JCMT and SMA are located within hundreds of meters of each other on Maunakea. The small angular separation is



keynote on Thursday by Sara Issaoun

Gravitational waves



credit: LIGO/Caltech/MIT/LSC

👤 Leo Singer, SciPy 2018 keynote

Role of Python in Recent Gravitational Wave Astronomy Breakthroughs
with LIGO and Virgo

<https://www.youtube.com/watch?v=PiZ0gxAiGuU>



GW150914: First results from the search for binary black hole coalescence with Advanced LIGO

B. P. Abbott *et al.**

(LIGO Scientific Collaboration and Virgo Collaboration)

(Received 9 March 2016; published 7 June 2016)

On September 14, 2015, at 09:50:45 UTC the two detectors of the Laser Interferometer Gravitational-Wave Observatory (LIGO) simultaneously observed the binary black hole merger GW150914. We report the results of a matched-filter search using relativistic models of compact-object binaries that recovered

masses from $1 M_{\odot}$ to $99 M_{\odot}$, total mass less than $100 M_{\odot}$ and dimensionless spins up to 0.99. The search was performed using two independently implemented analyses, referred to as PyCBC [3–5] and GstLAL [6–8]. These analyses use a common set of template waveforms [9–11], but differ in their implementations of matched filtering

```
Requires: gstreamer >= @MIN_GSTREAMER_VERSION@
Requires: lal >= @MIN_LAL_VERSION@
Requires: lalburst >= @MIN_LALBURST_VERSION@
Requires: lalmetaio >= @MIN_LALMETAIO_VERSION@
Requires: lalinspiral >= @MIN_LALINSPIRAL_VERSION@
Requires: lalsimulation >= @MIN_LALSIMULATION_VERSION@
Requires: numpy >= @MIN_NUMPY_VERSION@
Requires: orc >= @MIN_ORC_VERSION@
Requires: python >= @MIN_PYTHON_VERSION@
Requires: python-{gstreamername}
Requires: python-gobject >= @MIN_PYGOBJECT_VERSION@
Requires: python2-lal >= @MIN_LAL_VERSION@
Requires: python-ligo-lw >= @MIN_LIGO_LW_VERSION@
Requires: python2-ligo-segments >= @MIN_LIGO_SEGMENTS_VERSION@
Requires: scipy
Requires: zlib
BuildRequires: doxygen >= @MIN_DOXYGEN_VERSION@
```

gwastro / pycbc

<> Code

Issues 80

Pull requests 23

Project

Branch: master

pycbc / requirements.txt

sum33it Adding support for dynesty sampler. (#2832)

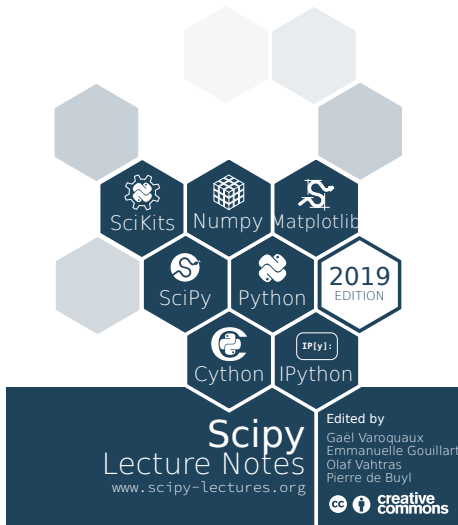
12 contributors



43 lines (38 sloc) | 1020 Bytes

```
1 # requirements for most basic library use
2 astropy>=2.0.3,<3.0.0; python_version <= '2.7'
3 astropy>=2.0.3; python_version >= '3.0'
4 Mako>=1.0.1
5 decorator>=3.4.2
6 scipy>=0.16.0; python_version >= '3.5'
7 scipy>=0.16.0,<1.3.0; python_version <= '3.4'
8 matplotlib>=2.0.0
9 numpy>=1.13.0,<1.15.3; python_version <= '2.7'
10 numpy>=1.13.0; python_version >= '3.0'
11 pillow
```

Tutorial on the scientific Python ecosystem



Gaël Varoquaux • Emmanuelle Gouillart • Olaf Vahtras • Pierre de Buyt
Christopher Burns • Adrian Chauve • Robert Cimrman • Christophe Combelles
Ralf Gommers • André Espaze • Zbigniew Jędrzejewski-Szmek
Valentin Haenel • Gert-Ludwig Ingold • Fabian Pedregosa • Didrik Pinte
Nicolas P. Rougier • Joris Van den Bossche • Pauli Virtanen

and many others...

docs.scipy.org



Welcome! This is the documentation for Numpy and Scipy.

For contributors:

[Numpy developer guide](#)

[Scipy developer guide](#)

Latest releases:

[Complete Numpy Manual \(HTML+zip\)](#)

[Numpy Reference Guide](#)
(PDF)

[Numpy User Guide](#)
[\[PDF\]](#)

[F2Py Guide](#)

[Scipy Reference Guide](#)
(HTML+zip), (PDF)

Others:

For newer versions see
<https://www.numpy.org/doc> or

Numpy (development version) Reference Guide

[Numpy \(development version\) User Guide](#)

[Numpy 1.17.0 Reference Guide, \[HTML+zip\], \[PDF\]](#)

[Numpy 1.17.0 User Guide \(PDF\)](#)

[Home » 46 » Reference Guide » RPTM exist](#)[Scipy \(development version\) Reference Guide](#)[Scipy 1.3.0 Reference Guide \(HTML\) +2101 \(PDF\)](#)

[Scipy 1.2.1 Reference Guide, \[HTML+zip\], \[PDF\]](#)

[Scipy 1.2.0 Reference Guide](#), [\[HTML+zip\]](#), [\[PDF\]](#)

[Scipy 1.1.0 Reference Guide, \[HTML+zip\], \[PDF\]](#)

[Scipy 1.0.0 Reference Guide](#), [\[HTML+zip\]](#), [\[PDF\]](#)

[Scipy 0.19.1 Reference Guide, \[HTML+zip\], \[PDF\]](#)

SEE ALSO:
[Mailing Lists of Q & A \(on stackoverflow.com\)](#)
[or](#)
[Scipy Lecture](#)

SciPy.org Docs

Release: 1.3.0
Date: May 17, 2019

SciPy (pronounced "Sigh Pie") is open-source software for mathematics, science, and engineering.

- Installing and upgrading
- API - importing from SciPy
- Release Notes

Tutorials with worked examples and background information for most SciPy submodules

- SciPy Tutorial
 - Introduction
 - Basic functions
 - Special functions (`scipy.special`)
 - Integration (`scipy.integrate`)
 - Optimization (`scipy.optimize`)
 - Interpolation (`scipy.interpolate`)
 - Fourier Transforms (`scipy.fftpack`)
 - Signal Processing (`scipy.signal`)
 - Linear Algebra (`scipy.linalg`)
 - Sparse Eigenvalue Problems with ARPACK
 - Compressed Sparse Graph Routines (`scipy.sparse.csgraph`)
 - Spatial data structures and algorithms (`scipy.spatial`)
 - Statistics (`scipy.stats`)
 - Multidimensional image processing (`scipy.ndimage`)
 - File IO (`scipy.io`)

Explanations of how to start contributing to SciPy, and descriptions of maintenance activities and policies.

- [SciPy Code of Conduct](#)
- [Contributing to SciPy](#)
- [Building from sources](#)
- [SciPy Developer Guide](#)

To get an overview of where help or new features are desired or planned, see the roadmap.

- [SciPy Roadmap](#)
- [Detailed SciPy Roadmap](#)
- [Toolchain Roadmap](#)

The exact API of all functions and classes, as given by the docstrings. The API documents expected types and allowed features for all functions, and all parameters available for the algorithms.

- Clustering package ([scipy.cluster](#))
- Constants ([scipy.constants](#))
- Discrete Fourier transforms ([scipy.fftpack](#))
- Integration and ODEs ([scipy.integrate](#))
- Interpolation ([scipy.interpolate](#))
- Input and output ([scipy.io](#))
- Linear algebra ([scipy.linalg](#))
- Miscellaneous routines ([scipy.misc](#))
- Multi-dimensional image processing ([scipy.ndimage](#))
- Orthogonal distance regression ([scipy.odr](#))
- Optimization and Root Finding ([scipy.optimize](#))
- Signal processing ([scipy.signal](#))
- Sparse matrices ([scipy.sparse](#))
- Sparse linear algebra ([scipy.sparse.linalg](#))
- Compressed Sparse Row regression ([scipy.sparse.csrgraph](#))
- Spatial algorithms and data structures ([scipy.spatial](#))
- Special functions ([scipy.special](#))
- Statistical functions ([scipy.stats](#))
- Statistical functions with associated arrays ([scipy.stats.mstats](#))
- Symbolic calculus functions

A brief history of SciPy

SciPy 1.0—Fundamental Algorithms for Scientific Computing in Python

Pauli Virtanen¹, Ralf Gommers^{2,*}, Travis E. Oliphant^{3,4,5,6,2}, Matt Haberland^{7,8,*}, Tyler Reddy^{9,*}, David Cournapeau¹⁰, Evgeni Burovski¹¹, Pearu Peterson^{12,13}, Warren Weckesser¹⁰, Jonathan Bright¹⁴, Stéfan J. van der Walt¹⁵, Matthew Brett¹⁶, Joshua Wilson¹⁰, K. Jarrod Millman^{15,17}, Nikolay Mayorov¹⁸, Andrew R. J. Nelson¹⁹, Eric Jones⁵, Robert Kern⁵, Eric Larson²⁰, CJ Carey²¹, İlhan Polat¹⁰, Yu Feng²², Eric W. Moore²³, Jake VanderPlas²⁴, Denis Laxalde¹⁰, Josef Perktold¹⁰, Robert Cimrman²⁵, Ian Henriksen²⁶, E. A. Quintero¹⁰, Charles R Harris¹⁰, Anne M. Archibald²⁷, Antônio H. Ribeiro²⁸, Fabian Pedregosa²⁹, Paul van Mulbregt³⁰, and SciPy 1.0 Contributors

<https://arxiv.org/abs/1907.10121>

NumPy/SciPy Documentation

cluster	clustering package
constants	constants
fftpack	discrete Fourier transforms
integrate	integration and ordinary differential equations
interpolate	interpolation
io	input and output
linalg	linear algebra
misc	miscellaneous routines
ndimage	multi-dimensional image processing
odr	orthogonal distance regression
optimize	optimization and root finding
signal	signal processing
sparse	sparse matrices
spatial	spatial algorithms and data structures
special	special functions
stats	statistical functions

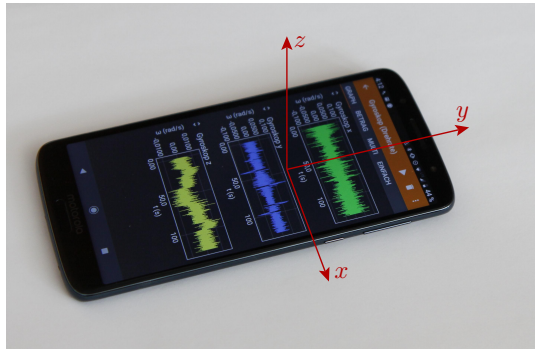
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Taking data with the smartphone



smartphone app developed by the
2nd Institute of Physics of the RWTH Aachen University
see phyphox.org for more information



TGV Duplex

