Stellar Formation and Evolution Supplementary Notes 01

Kinoshita Daisuke

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Institute of Astronomy, National Central University, Taiwan

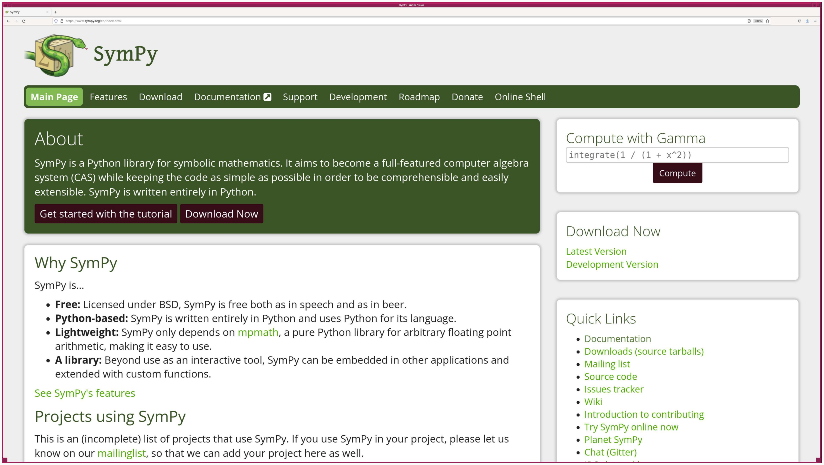
Sample Python scripts

- GitHub repository
  - https://github.com/kinoshitadaisuke
  - https://github.com/kinoshitadaisuke/ncu_stellarevolution_202302
  - https://github.com/kinoshitadaisuke/ncu_stellarevolution_202302/tree/main/s05
- Binder
  - https://mybinder.org/v2/gh/kinoshitadaisuke/ncu_stellarevolution_202302/HEAD

Python package “SymPy”

- SymPy
  - A Python package for symbolic mathematics.
  - `https://www.sympy.org/`

Python package "SymPy"



About

SymPy is a Python library for symbolic mathematics. It aims to become a full-featured computer algebra system (CAS) while keeping the code as simple as possible in order to be comprehensible and easily extensible. SymPy is written entirely in Python.

Why SymPy

SymPy is...

- **Free:** Licensed under BSD, SymPy is free both as in speech and as in beer.
- **Python-based:** SymPy is written entirely in Python and uses Python for its language.
- **Lightweight:** SymPy only depends on mpmath, a pure Python library for arbitrary floating point arithmetic, making it easy to use.
- **A library:** Beyond use as an interactive tool, SymPy can be embedded in other applications and extended with custom functions.

See SymPy's features

Projects using SymPy

This is an (incomplete) list of projects that use SymPy. If you use SymPy in your project, please let us know on our mailinglist, so that we can add your project here as well.

Compute with Gamma

```
integrate(1 / (1 + x^2))
```

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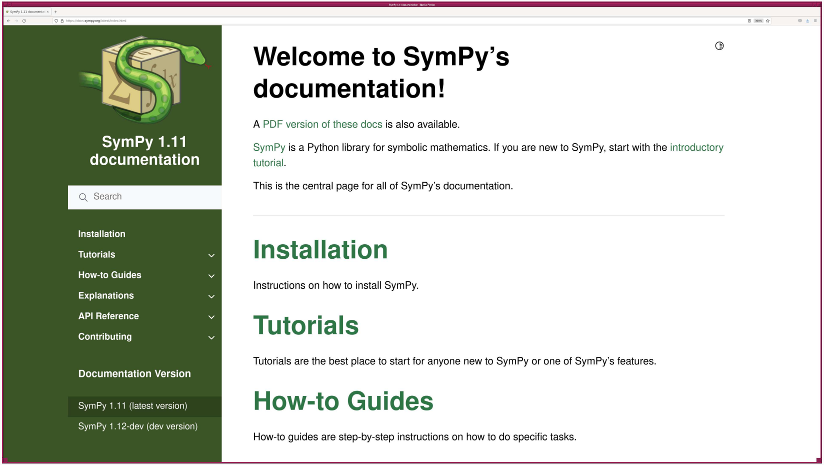
Development Version

Quick Links

- Documentation
- Downloads (source tarballs)
- Mailing list
- Source code
- Issues tracker
- Wiki
- Introduction to contributing
- Try SymPy online now
- Planet SymPy
- Chat (Gitter)

`https://www.sympy.org/`

Python package “SymPy”



SymPy 1.11 documentation

Search

- Installation
- Tutorials
- How-to Guides
- Explanations
- API Reference
- Contributing

Documentation Version

- SymPy 1.11 (latest version)
- SymPy 1.12-dev (dev version)

Welcome to SymPy’s documentation!

A PDF version of these docs is also available.

SymPy is a Python library for symbolic mathematics. If you are new to SymPy, start with the introductory tutorial.

This is the central page for all of SymPy’s documentation.

Installation

Instructions on how to install SymPy.

Tutorials

Tutorials are the best place to start for anyone new to SymPy or one of SymPy’s features.

How-to Guides

How-to guides are step-by-step instructions on how to do specific tasks.

`https://docs.sympy.org/`

Calculating $\int_0^{10} 2x dx$

sample Python script #00

```
# importing sympy module
import sympy

# variable
x = sympy.Symbol ('x')

# function f(x)
f = 2 * x

# integration of f(x)
I = sympy.integrate (f, (x, 0, 10))

# printing result
print (f'I = {I}')
```

Calculating $\int_0^{10} 2xdx$

executing sample Python script #00

```
% chmod a+x star_202302_s05_00.py
% ./star_202302_s05_00.py
I = 100
```

Calculating $\int_0^\pi \sin x dx$

sample Python script #01

```
# importing sympy module
import sympy

# variable
x = sympy.Symbol (’x’)

# function f(x)
f = sympy.sin (x)

# pi
pi = sympy.pi

# integration of f(x)
I = sympy.integrate (f, (x, 0, pi))

# printing result
print (f’I = {I}’)
```

Calculating $\int_0^{\pi} \sin x dx$

executing sample Python script #01

```
% chmod a+x star_202302_s05_01.py
% ./star_202302_s05_01.py
I = 2
```

Calculating $\int_0^2 \sqrt{4 - x^2}dx$

sample Python script #02

```
# importing sympy module
import sympy

# variable
x = sympy.Symbol (’x’)

# function f(x)
f = sympy.sqrt (4 - x**2)

# integration of f(x)
I = sympy.integrate (f, (x, 0, 2))

# printing result
print (f’I = {I}’)
```

Calculating $\int_0^2 \sqrt{4-x^2}dx$

executing sample Python script #02

```
% chmod a+x star_202302_s05_02.py
% ./star_202302_s05_02.py
I = pi
```

Calculating $\int_{-\infty}^{\infty} \exp\left(-x^2\right) dx$

sample Python script #03

```
# importing sympy module
import sympy

# variable
x = sympy.Symbol (’x’)
# function f(x)
f = sympy.exp (-x**2)

# positive infinity
pinf = sympy.oo
# negative infinity
ninf = -sympy.oo
# integration of f(x)
I = sympy.integrate (f, (x, ninf, pinf))

# printing result
print (f’I = {I}’)
```

Calculating $\int_{-\infty}^{\infty} \exp(-x^2) dx$

executing sample Python script #03

```
% chmod a+x star_202302_s05_03.py
% ./star_202302_s05_03.py
I = sqrt(pi)
```

Calculating $\int_0^{\infty} x^3 \exp\left(-x^2\right) dx$

sample Python script #04

```
# importing sympy module
import sympy

# variable
x = sympy.Symbol (’x’)

# function f(x)
f = x**3 * sympy.exp (-x**2)

# positive infinity
pinf = sympy.oo

# integration of f(x)
I = sympy.integrate (f, (x, 0, pinf))

# printing result
print (f’I = {I}’)
```

Calculating $\int_0^\infty x^3 \exp\left(-x^2\right) dx$

executing sample Python script #04

```
% chmod a+x star_202302_s05_04.py
% ./star_202302_s05_04.py
I = 1/2
```

Calculating $\int_0^\infty x^4 \exp\left(-x^2\right) dx$

sample Python script #05

```
# importing sympy module
import sympy

# variable
x = sympy.Symbol (’x’)

# function f(x)
f = x**4 * sympy.exp (-x**2)

# positive infinity
pinf = sympy.oo

# integration of f(x)
I = sympy.integrate (f, (x, 0, pinf))

# printing result
print (f’I = {I}’)
```

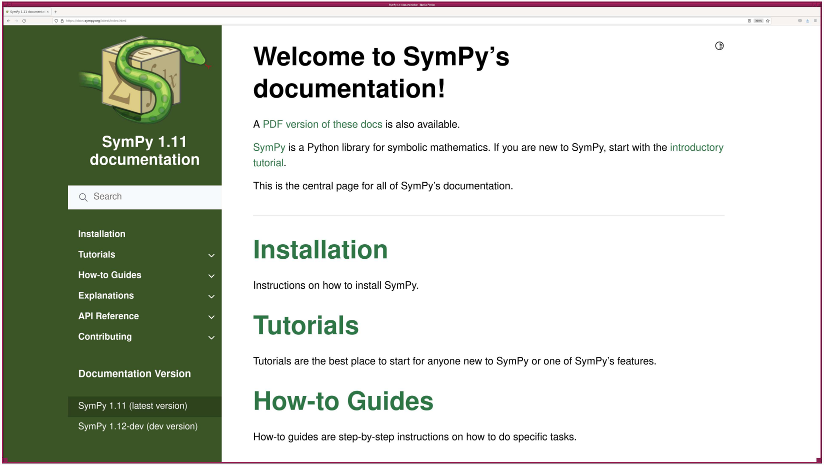
Calculating $\int_0^\infty x^4 \exp\left(-x^2\right) dx$

executing sample Python script #05

```
% chmod a+x star_202302_s05_05.py
% ./star_202302_s05_05.py
I = 3*sqrt(pi)/8
```

Document of “SymPy”

To know more about SymPy, read the official document.



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