

Title: Numerical Methods Lecture

Speakers: Dustin Lang

Collection: Numerical Methods 2023/24

Date: January 09, 2024 - 10:15 AM

URL: <https://pirsa.org/24010019>

Did you miss JuliaCon 2023? [Watch the 10th annual JuliaCon talks on YouTube!](#)



Download Documentation Learn Blog Community **Contribute** JSoC

Star 43,829

Sponsor



Julia in a Nutshell

Fast

Julia was designed for **high performance**. Julia programs automatically compile to efficient native code via LLVM and support **multiple**

Dynamic

Julia is **dynamically typed**, feels like a scripting language, and has good support for **interactive** use, but can also optionally be separately compiled

Reproducible

Reproducible environments make it possible to recreate the same Julia environment every time, across platforms with **pre-built binaries**

Current stable release: v1.10.0 (December 25, 2023)

Checksums for this release are available in both [SHA256](#) and [MD5](#) formats.

Platform	64-bit	32-bit
Windows [help]	installer , portable	installer , portable
macOS x86 (Intel or Rosetta) [help]	.dmg , .tar.gz	
macOS (Apple Silicon) [help]	.dmg , .tar.gz	
Generic Linux on x86 [help]	glibc (GPG) , musl^[1] (GPG)	glibc (GPG)
Generic Linux on ARM [help]	AArch64 (GPG)	
Generic Linux on PowerPC [help]	little endian (GPG)	
Generic FreeBSD on x86 [help]	.tar.gz (GPG)	

Source [Tarball \(GPG\)](#) [Tarball with dependencies \(GPG\)](#) [GitHub](#)



Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab
Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[2]: Int64
[3]: factorial(10)
[3]: 3628800
[4]: factorial(100)

OverflowError: 100 is too large to look up in the table; consider using `factorial(big(100))` instead

Stacktrace:
 [1] factorial_lookup
      @ Base ./combinatorics.jl:19 [inlined]
 [2] factorial(n::Int64)
      @ Base ./combinatorics.jl:27
 [3] top-level scope
      @ In[4]:1

[ ]:
```

Simple 0 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[9]: Float64
[10]: pi
[10]: π = 3.1415926535897...
[11]: pi + 1.0
[11]: 4.141592653589793
[12]: pi + big(1.0)
[12]: 4.141592653589793238462643383279502884197169399375105820974944592307816406286198
[13]: 2+3im
[13]: 2 + 3im
[ ]: typeo|
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 6 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[12]: pi + big(1.0)
[12]: 4.141592653589793238462643383279502884197169399375105820974944592307816406286198

[13]: 2+3im
[13]: 2 + 3im

[14]: typeof(2+3im)
[14]: Complex{Int64}

[15]: typeof(2.0+3im)
[15]: ComplexF64 (alias for Complex{Float64})

[ ]:
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	2 minutes ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[15]: ComplexF64 (alias for Complex{Float64})  
  
[16]: 1//2 + 3//4  
[16]: 5//4  
  
[17]: typeof(5//4)  
[17]: Rational{Int64}  
  
[18]: "hello"  
[18]: "hello"  
  
[19]: "hello" * "world"  
[19]: "helloworld"  
  
[ ]: |
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[21]: [1, 2, 3] + [4, 5, 6]
[21]: 3-element Vector{Int64}:
      5
      7
      9
[22]: 2 * [1, 2, 3]
[22]: 3-element Vector{Int64}:
      2
      4
      6
[23]: [1, 2, 3] * [4, 5, 6]
MethodError: no method matching *(::Vector{Int64}, ::Vector{Int64})
Closest candidates are:
 *(::Any, ::Any, ::Any, ::Any...)
   @ Base operators.jl:587
 *(::LinearAlgebra.Diagonal, ::AbstractVector)
   @ LinearAlgebra ~/.julia/juliaup/julia-1.10.0+0.x64.linux.gnu/share/julia/std
lib/v1.10/LinearAlgebra/src/diagonal.jl:283
 *(::Number, ::AbstractArray)
   @ Base arraymath.jl:21
```

Simple 0 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab
Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb
Code Julia 1.10.0

```
[22]: 2 * [1, 2, 3]
[22]: 3-element Vector{Int64}:
      2
      4
      6
[23]: [1, 2, 3] * [4, 5, 6]
MethodError: no method matching *(::Vector{Int64}, ::Vector{Int64})
Closest candidates are:
 *(::Any, ::Any, ::Any, ::Any...)
   @ Base operators.jl:587
 *(::LinearAlgebra.Diagonal, ::AbstractVector)
   @ LinearAlgebra ~/.julia/juliaup/julia-1.10.0+0.x64.linux.gnu/share/julia/std
lib/v1.10/LinearAlgebra/src/diagonal.jl:283
 *(::Number, ::AbstractArray)
   @ Base arraymath.jl:21
 ...
Stacktrace:
 [1] top-level scope
      @ In[23]:1
```

Simple 0 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[24]: 3-element Vector{Int64}:  
      4  
      10  
      18  
  
[25]: [1, 2, 3] .^ 2  
  
[25]: 3-element Vector{Int64}:  
      1  
      4  
      9  
  
[26]: sin.([1, 2, 3])  
  
[26]: 3-element Vector{Float64}:  
      0.8414709848078965  
      0.9092974268256817  
      0.1411200080598672  
  
[ ]:
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[27]: vcat([1, 2], [3])  
  
[27]: 3-element Vector{Int64}:  
      1  
      2  
      3  
  
[28]: xs = [1, 2, 3]  
  
[28]: 3-element Vector{Int64}:  
      1  
      2  
      3  
  
[29]: xs[1]  
  
[29]: 1  
  
[ ]: |
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[28]: xs = [1, 2, 3]
[28]: 3-element Vector{Int64}:
      1
      2
      3
[29]: xs[1]
[29]: 1
[30]: randn(3, 3)
[30]: 3x3 Matrix{Float64}:
 0.758336 -0.868006 -0.362037
 0.207016 -0.206519  1.58364
 1.14189  0.174905  0.511454
[ ]: |
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[31]: 3x3 Matrix{Float64}:
      -1.51278  2.73769 -2.19024
      -0.106862 -0.774805 -1.24663
      -0.0417874 -0.491228  1.47668

[32]: x = randn(3)

[32]: 3-element Vector{Float64}:
      -1.4036011779086688
       0.17261180552438005
       0.1297101820539355

[33]: A * x

[33]: 3-element Vector{Float64}:
       2.311798119328227
      -0.14544866277801513
       0.16540203296621303

[ ]: A
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 2 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[32]: 3-element Vector{Float64}:
      -1.4036011779086688
       0.17261180552438005
       0.1297101820539355

[33]: A * x

[33]: 3-element Vector{Float64}:
      2.311798119328227
     -0.14544866277801513
      0.16540203296621303

[34]: A'

[34]: 3×3 adjoint(::Matrix{Float64}) with eltype Float64:
      -1.51278  -0.106862  -0.0417874
       2.73769  -0.774805  -0.491228
      -2.19024  -1.24663   1.47668

[ ]: A == |
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 6 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local Tue Jan 9 10:36
 home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	2 minutes ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```

2.311798119328227
-0.14544866277801513
0.16540203296621303

[34]: A'

[34]: 3x3 adjoint(::Matrix{Float64}) with eltype Float64:
-1.51278 -0.106862 -0.0417874
 2.73769 -0.774805 -0.491228
-2.19024 -1.24663  1.47668

[35]: A' == A

[35]: true

[36]: A \ x

[36]: 3-element Vector{Float64}:
 0.40483999112955876
-0.28554582585925503
 0.004306385539309116

[ ]: |
  
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab
Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Control structures

```
[40]: xs = zeros(10)
      for i in 1:10
          xs[i] = 2*i+1
      end
      xs
```

```
[40]: 10-element Vector{Float64}:
       3.0
       5.0
       7.0
       9.0
      11.0
      13.0
      15.0
      17.0
      19.0
      21.0
```

```
[ ]: |
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab Download Julia

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
21.0

[41]: xs = zeros(10)
      for i in 1:10
        if i > 5
          xs[i] = 2*i+1
        elseif i < 2
          xs[i] = i
        else
          xs[i] = 0
        end
      end
      xs

[41]: 10-element Vector{Float64}:
      1.0
      0.0
      0.0
      0.0
      0.0
      13.0
      15.0
      17.0
      19.0
      21.0
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb



Search docs

Julia Documentation

- Important Links
- Introduction
- Julia Compared to Other Languages

Manual >

Base >

Standard Library >

Developer Documentation >

Version v1.10.0

Go to #man-important-links on this page

Julia Documentation

Edit on GitHub

Julia 1.10 Documentation

Welcome to the documentation for Julia 1.10.

Please read the [release notes](#) to see what has changed since the last release.

Note

The documentation is also available in PDF format: [julia-1.10.0.pdf](#).

Important Links

Below is a non-exhasutive list of links that will be useful as you learn and use the Julia programming language.

- [Julia Homepage](#)
- [Download Julia](#)
- [Discussion forum](#)
- [Julia YouTube](#)
- [Find Julia Packages](#)

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab Julia Documentation - The Julia Language

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb

Code Julia 1.10.0

```
1.0
0.0
0.0
0.0
0.0
13.0
15.0
17.0
19.0
21.0
```

```
[ ]: function count_squares(n)
    count = 0
    for i in 1:n
        if round(sqrt(i)) == sqrt(i)
            count += 1
        end
    end
    return count
end
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Saving completed Mode: Edit Ln 9, Col 4 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab Julia Documentation · The Julia Language

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb

```
1.0
0.0
0.0
0.0
0.0
13.0
15.0
17.0
19.0
21.0
```

```
[42]: function count_squares(n)
      count = 0
      for i in 1:n
          if round(sqrt(i)) == sqrt(i)
              count += 1
          end
      end
      return count
end
```

```
[42]: count_squares (generic function with 1 method)
```

```
[ ]:
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

```
return count
end

[48]: count_squares (generic function with 1 method)

[49]: count_squares(0)
[49]: 0

[44]: count_squares(10)
[44]: 3

[45]: count_squares(100)
[45]: 10

[ ]: [count_squares(n) for n in 0:10:100]
```




Home

- > Reference
- > Tutorials
- > How-Tos
- > Explanations
- API
- News

Welcome to Makie!

Makie is a data visualization ecosystem for the [Julia](#) programming language, with high performance and extensibility. It is available for Windows, Mac and Linux.

Example

```
using GLMakie # All functionality is defined in Makie and every backend re-exports Makie

Base.@kwdef mutable struct Lorenz
    dt::Float64 = 0.01
    σ::Float64 = 10
    ρ::Float64 = 28
end
```

Example

- Installation and Import
- First Steps
- Makie Ecosystem
 - Extensions and Resources
- Citing Makie
- Getting Help



Reference

Tutorials

How-Tos

Explanations

API

News



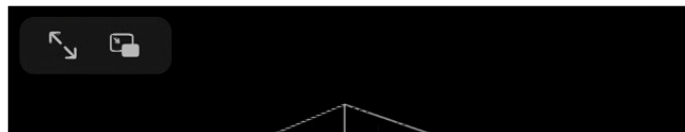
Welcome to Makie!

Makie is a data visualization ecosystem for the [Julia](#) programming language, with high performance and extensibility. It is available for Windows, Mac and Linux.

Example

```
using GLMakie # All functionality is defined in Makie and every backend re-exports Makie

Base.@kwdef mutable struct Lorenz
    dt::Float64 = 0.01
    σ::Float64 = 10
end
```



Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab
Julia Documentation - The Julia Language
Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb

Code Julia 1.10.0

```
(0, 0)
(10, 3)
(20, 4)
(30, 5)
(40, 6)
(50, 7)
(60, 7)
(70, 8)
(80, 8)
(90, 9)
(100, 10)
```

Plotting

```
[52]: using WGLMakie
```

```
[ ]: linespoi
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 9 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab
 Julia Documentation - The Julia Language
 Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb
 Code Julia 1.10.0

```
[54]: WGLMakie.lines(randn(5, 2))
```

Warning: Port in use, using different port. New port: 9385
 @ Bonito.HTTPServer ~/.julia/packages/Bonito/679K1/src/HTTPServer/implementation.jl:274

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Command Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help symmetry.pi.local Tue Jan 9 10:52

home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

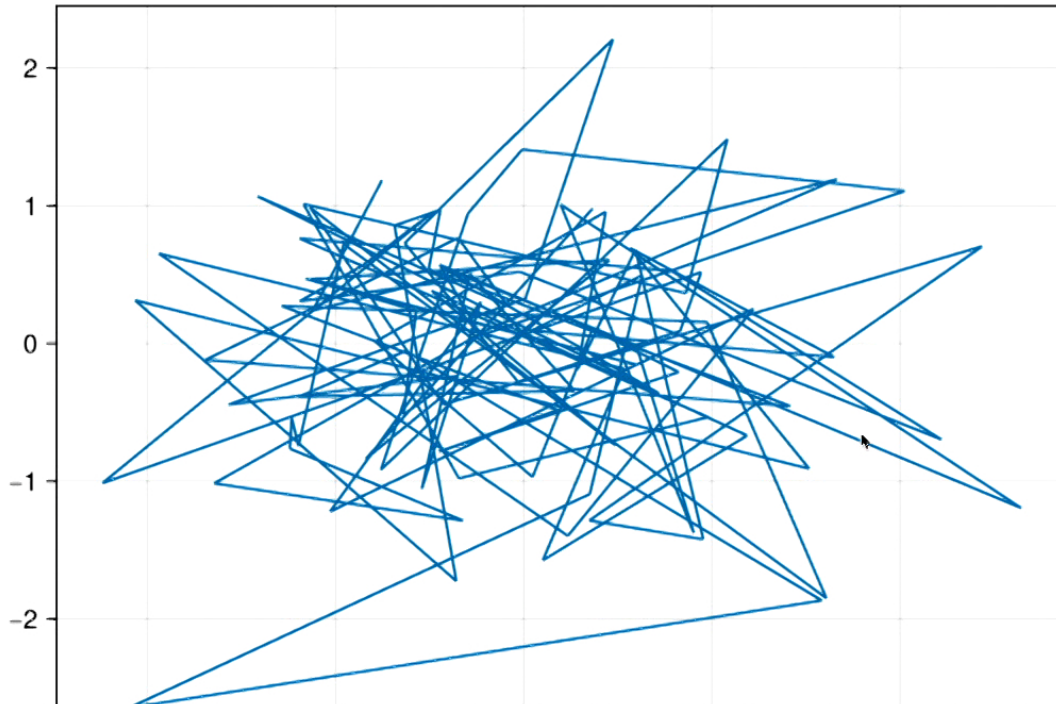
/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[55]: WGLMakie.lines(randn(101, 2))
```

[55]:



Simple 0 2 Julia 1.10.0 | Idle Mode: Command Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab
Julia Documentation - The Julia Language
Home - Makie

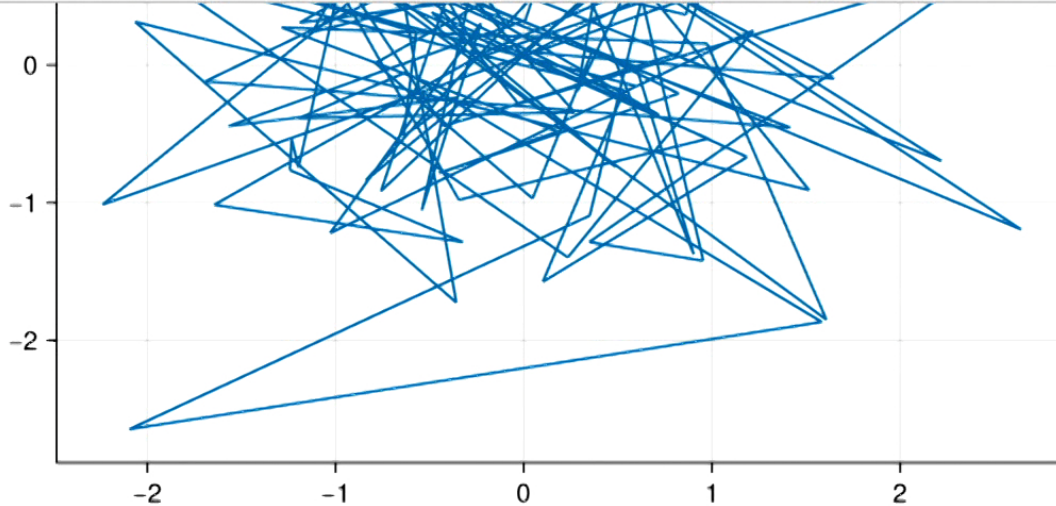
File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb
Code Julia 1.10.0



```
[56]: xs = 0.0:0.1:2*pi
```

```
[56]: 0.0:0.1:6.2
```

```
[ ]: |
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab
Julia Documentation - The Julia Language
Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb

Code Julia 1.10.0

Simple 0 2 Julia 1.10.0 | Idle Mode: Command Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

Code

Plotting

```
[58]: using Pkg
```

```
[*]: Pkg.add("WGLMakie")
```

Resolving package versions...
 No Changes to ~/.julia/environments/v1.10/Project.toml`
 No Changes to ~/.julia/environments/v1.10/Manifest.toml`

```
[52]: using WGLMakie
```

```
[55]: WGLMakie.lines(randn(101, 2))
```

```
[55]:
```

Simple 0 2 Julia 1.10.0 | Busy Mode: Command Ln 1, Col 15 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab
Julia Documentation - The Julia Language
Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	2 minutes ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Plotting

```
[58]: using Pkg  
[60]: Pkg.rm("WGLMakie")  
Updating `~/julia/environments/v1.10/Project.toml`  
[276b4fcb] - WGLMakie v0.9.4  
Updating `~/julia/environments/v1.10/Manifest.toml`  
[824d6782] - Bonito v3.0.3  
[47d2ed2b] - Hyperscript v0.0.5  
[99f44e22] - MsgPack v1.2.1  
[b189fb0b] - ThreadPools v2.1.1  
[276b4fcb] - WGLMakie v0.9.4  
[ead4739] - WidgetsBase v0.1.4  
[04572ae6] - Deno_jll v1.33.4+0  
[52]: using WGLMakie  
[55]: WGLMakie.lines(randn(101, 2))  
[55]:
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Command Ln 1, Col 15 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

Plotting

```
[58]: using Pkg

[61]: Pkg.add("WGLMakie")

Resolving package versions...
Updating ~/.julia/environments/v1.10/Project.toml`
[276b4fcb] + WGLMakie v0.9.4
Updating ~/.julia/environments/v1.10/Manifest.toml`
[824d6782] + Bonito v3.0.3
[47d2ed2b] + Hyperscript v0.0.5
[99f44e22] + MsgPack v1.2.1
[b189fb0b] + ThreadPools v2.1.1
[276b4fcb] + WGLMakie v0.9.4
[eead4739] + WidgetsBase v0.1.4
[04572ae6] + Deno_jll v1.33.4+0

[52]: using WGLMakie

[55]: WGLMakie.lines(randn(101, 2))

[55]:
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Command Ln 1, Col 15 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab
 Julia Documentation - The Julia Language
 Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb
 Code Julia 1.10.0

Type system

```
[62]: typeof(1)
[62]: Int64
[63]: typeof([1, 2, 3])
[63]: Vector{Int64} (alias for Array{Int64, 1})
[64]: struct IntPoint
      x::Int
      y::Int
      end
[ ]: Int|
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 4 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab
 Julia Documentation - The Julia Language
 Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	in a few seconds
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb

Code Julia 1.10.0

```

@ Base ./Base.jl:41
[2] top-level scope
@ In[68]:1

[69]: struct Point{T}
       x::T
       y::T
       end

[70]: Point{Int}(1, 2)
[70]: Point{Int64}(1, 2)

[71]: Point{Float64}(1, 2)
[71]: Point{Float64}(1.0, 2.0)

[72]: Point(1, 2)
[72]: Point{Int64}(1, 2)

[ ]:
  
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Saving completed Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```

@ Base ./Base.jl:41
[2] top-level scope
@ In[68]:1

[69]: struct Point{T}
      x::T
      y::T
      end

[70]: Point{Int}(1, 2)
[70]: Point{Int64}(1, 2)

[71]: Point{Float64}(1, 2)
[71]: Point{Float64}(1.0, 2.0)

[72]: Point(1, 2)
[72]: Point{Int64}(1, 2)

[ ]: function add(p::Point{T}, q::Point{T}) whe
  
```

Simple 0 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 43 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
symmetry.pi.local
home/eschnetter - JupyterLab
Julia Documentation - The Julia Language
Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb
Code Julia 1.10.0

```
[71]: Point{Float64}(1, 2)
[71]: Point{Float64}(1.0, 2.0)
[72]: Point(1, 2)
[72]: Point{Int64}(1, 2)
[73]: function add(p::Point{T}, q::Point{T}) where {T}
      return Point{T}(p.x + q.x, p.y + q.y)
      end
[73]: add (generic function with 1 method)
[ ]: |
```

Simple 0 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab
 Julia Documentation - The Julia Language
 Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	2 minutes ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb

Code Julia 1.10.0

```
[71]: Point{Float64}(1.0, 2.0)

[72]: Point(1, 2)

[72]: Point{Int64}(1, 2)

[73]: function add(p::Point{T}, q::Point{T}) where {T}
      return Point{T}(p.x + q.x, p.y + q.y)
      end

[73]: add (generic function with 1 method)

[74]: add(Point(1, 2), Point(2, 3))

[74]: Point{Int64}(3, 5)

[75]: add(Point(1.0, 2.0), Point(2.0, 3.0))

[75]: Point{Float64}(3.0, 5.0)

[ ]:
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 2 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 Tue Jan 9 11:03
 home/eschnetter - JupyterLab
 Julia Documentation - The Julia Language
 Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```

.text
.file "add"
.globl julia_add_5218          # -- Begin function julia_add_52
18
.p2align      4, 0x90
.type        julia_add_5218,@function
julia_add_5218:                # @julia_add_5218
; | @ In[73]:1 within `add`
# %bb.0:                        # %top
    push    rbp
    mov     rbp, rsp
    mov     rax, rdi
; | @ In[73]:2 within `add`
; | @ float.jl:409 within `+`
    vmovupd xmm0, xmmword ptr [rsi]
    vaddpd  xmm0, xmm0, xmmword ptr [rdx]
; | L
    vmovupd xmmword ptr [rdi], xmm0
    pop     rbp
    ret
.Lfunc_end0:
.size      julia_add_5218, .Lfunc_end0-julia_add_5218
; L
                                # -- End function
.section      ".note.GNU-stack","",@progbits

```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local Tue Jan 9 11:04
 home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	2 minutes ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```

.text
.file "add"
.globl julia_add_5241          # -- Begin function julia_add_52
41
.p2align      4, 0x90
.type        julia_add_5241,@function
julia_add_5241:                # @julia_add_5241
; | @ In[73]:1 within `add`
# %bb.0:                        # %top
    push    rbp
    mov     rbp, rsp
    mov     rax, rdi
; | @ In[73]:2 within `add`
; | @ int.jl:87 within `+`
    vmovdqu xmm0, xmmword ptr [rdx]
    vpaddq  xmm0, xmm0, xmmword ptr [rsi]
; | L
    vmovdqu xmmword ptr [rdi], xmm0
    pop    rbp
    ret
.Lfunc_end0:
.size      julia_add_5241, .Lfunc_end0-julia_add_5241
; L
                                # -- End function
.section      ".note.GNU-stack","",@progbits

```

[]: |

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local Tue Jan 9 11:05
 home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb x

Code Julia 1.10.0

```

push    rop
mov     rbp, rsp
mov     rax, rdi
; | @ In[73]:2 within `add`
; | @ int.jl:87 within `+`
vmovdqu xmm0, xmmword ptr [rdx]
vpaddq  xmm0, xmm0, xmmword ptr [rsi]
; | L
vmovdqu xmmword ptr [rdi], xmm0
pop     rbp
ret
.Lfunc_end0:
.size   julia_add_5241, .Lfunc_end0-julia_add_5241
; L
                                # -- End function
.section      ".note.GNU-stack","",@progbits
[ ]: |

```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	2 minutes ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```

push    rbp
mov     rbp, rsp
mov     rax, rdi
; | @ In[73]:2 within `add`
; | @ int.jl:87 within `+`
vmovdqu xmm0, xmmword ptr [rdx]
vpaddq  xmm0, xmm0, xmmword ptr [rsi]
; | L
vmovdqu xmmword ptr [rdi], xmm0
pop     rbp
ret
.Lfunc_end0:
.size   julia_add_5241, .Lfunc_end0-julia_add_5241
; L
                                # -- End function
.section      ".note.GNU-stack","",@progbits

```

•[80]: obj.fun(x, y)
 fun(obj, x, y)|

UndefVarError: `obj` not defined

Stacktrace:
 [1] top-level scope
 @ In[80]:1

[]:

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 2, Col 15 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	seconds ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	in a few seconds
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```
[82]: quote
      #= In[82]:2 =#
      2 + 3
      end

[83]: :(2 + 3)

[83]: :(2 + 3)

[84]: :(2 + 3) |> dump
Expr
head: Symbol call
args: Array{Any}((3,))
 1: Symbol +
 2: Int64 2
 3: Int64 3

[ ]: :(2 + 3) |> dump
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 17 Julia Introduction.ipynb

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab Julia Documentation - The Julia Language Home - Makie

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb Julia 1.10.0

```

3: Expr
  head: Symbol call
  args: Array{Any}((3,))
    1: Symbol *
    2: Symbol b
    3: Symbol c

[88]: ::((2 + b) * c) |> dump

Expr
  head: Symbol call
  args: Array{Any}((3,))
    1: Symbol *
    2: Expr
      head: Symbol call
      args: Array{Any}((3,))
        1: Symbol +
        2: Int64 2
        3: Symbol b
    3: Symbol c

[ ]:

```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Edit Ln 1, Col 1 Julia Introduction.ipynb



The Canadian Hydrogen Observatory and Radio-transient Detector

IT

- Instrument
- Science
- News
- Publications
- Gallery



The core array will be hosted at the Dominion Radio Astrophysical Observatory, which is situated on the traditional unceded territory of the [Siyix](#) people.

Safari File Edit View History Bookmarks Develop Window Help
 symmetry.pi.local
 home/eschnetter - JupyterLab
 Julia Documentation - The Julia Language Home - Makie Home

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/ home / eschnetter /

Name	Last Modified
Julia Intro...	a minute ago
Julia-Dem...	3 years ago
julia-mpi-...	2 years ago
jupyterhu...	seconds ago
jupyterhu...	3 months ago
jupyterhu...	17 days ago
Linear Alg...	a year ago
Linear Alg...	7 years ago
Mandelbr...	9 years ago
MaxwellTo...	4 years ago
MCFM-10...	3 years ago
mn003-c...	3 months ago
octave-wo...	7 years ago
ODE Integ...	a year ago
Parallel Pr...	4 years ago

Julia Introduction.ipynb x

Code Julia 1.10.0

```

3: Expr
  head: Symbol call
  args: Array{Any}((3,))
    1: Symbol *
    2: Symbol b
    3: Symbol c

[88]: ::((2 + b) * c) |> dump

Expr
  head: Symbol call
  args: Array{Any}((3,))
    1: Symbol *
    2: Expr
      head: Symbol call
      args: Array{Any}((3,))
        1: Symbol +
        2: Int64 2
        3: Symbol b
    3: Symbol c

[ ]:
  
```

Simple 0 \$ 2 Julia 1.10.0 | Idle Mode: Command Ln 1, Col 1 Julia Introduction.ipynb