

What do we do?

"The Angry Penguin", used under creative commons licence from Swantje Hess and Jannis Pohlmann.



Warwick RSE

Who Are We?

- Chris Brady, Heather Ratcliffe and shared with sysadmins Arkadiy Davydov
- CB - previously laser plasma physicist, sysadmin, contract programmer
- HR - previously astrophysics/solar physics
- AD - previously computational solid state physicist
- Collectively
 - Physics and HPC backgrounds
 - Experienced C/C++/Fortran developers
 - Data analysis/reduction

LMFDB (Maths)



The L-functions and modular forms database (LMFDB)

Feedback · Hide Menu

Introduction

Overview Random
Universe Knowledge

L-functions

Rational All

Modular forms

Classical Maass
Hilbert Bianchi

Varieties

Elliptic curves over \mathbb{Q}
Elliptic curves over $\mathbb{Q}(\alpha)$
Genus 2 curves over \mathbb{Q}
Higher genus families
Abelian varieties over \mathbb{F}_q

Fields

Number fields
 p -adic fields

Representations

Dirichlet characters
Artin representations

Groups

Galois groups
Sato-Tate groups

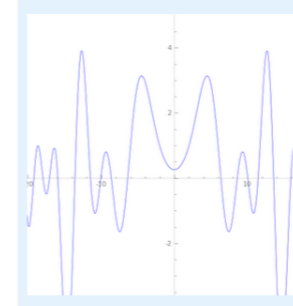
First complex critical zero	Underlying object	N	χ	arithmetic	self-dual
17.02494	odd Maass	1	-	○	●
11.78454	odd Maass	2	-	○	●
11.61497	even Maass	3	-	○	●
9.22237	holomorphic	1	-	●	●
7.21458	K3 surface, Hecke character, holomorphic	7	(-)	●	●
6.71631	holomorphic	5	(!)	●	○
6.56108	holomorphic	3	(-)	●	○
6.50210	even Maass	10	-	○	●
6.48044	Catalan's 3-fold, holomorphic	6	-	●	●
6.36261	elliptic curve, holomorphic	11	-	●	●
5.10553	odd Maass	1	-	○	●
4.06350	holomorphic	5	(!)	●	○

A database

The LMFDB is an extensive database of mathematical objects arising in Number Theory.

Sample lists: [L-functions](#), [Elliptic curves](#), [Tables of zeros](#), [Number fields](#)

Save the date: [LuCaNT 2023](#)



Hall of fame

Riemann zeta function
Ramanujan Δ function and its L-function
C277 and its L-function
Gauss elliptic curve and its L-function
Grand Canyon L-function

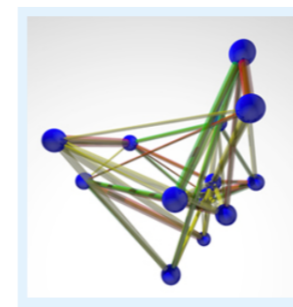


Search and browse

Search for objects with specific properties, or browse categories.

Browse: [L-functions](#), [Modular forms](#), [Elliptic curves](#), [Number fields](#)

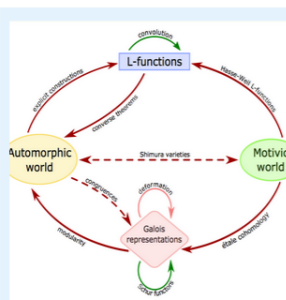
[See a random object from the database](#)



Visualize data

Explore individual plots or view distributions of various objects.

Examples: [GL\(4\) Level one Maass forms](#), [Isogeny graph of elliptic curve 102.c](#)



Explore and learn

The LMFDB makes visible the connections predicted by the Langlands program. Knowls offer background information when you need it.

[LMFDB universe](#) [Knowledge](#)

```

sage E.conductor().factor()
N      = 2 * 117223
sage E.discriminant().factor()
Delta  = 2^2 * 117223
sage E.j_invariant().factor()
j      = 2^-2 * 3^3 * 7^3 * 181^2
End(E) = Z

```

Code and open software

Download the data, download the code, or see how the data was generated.

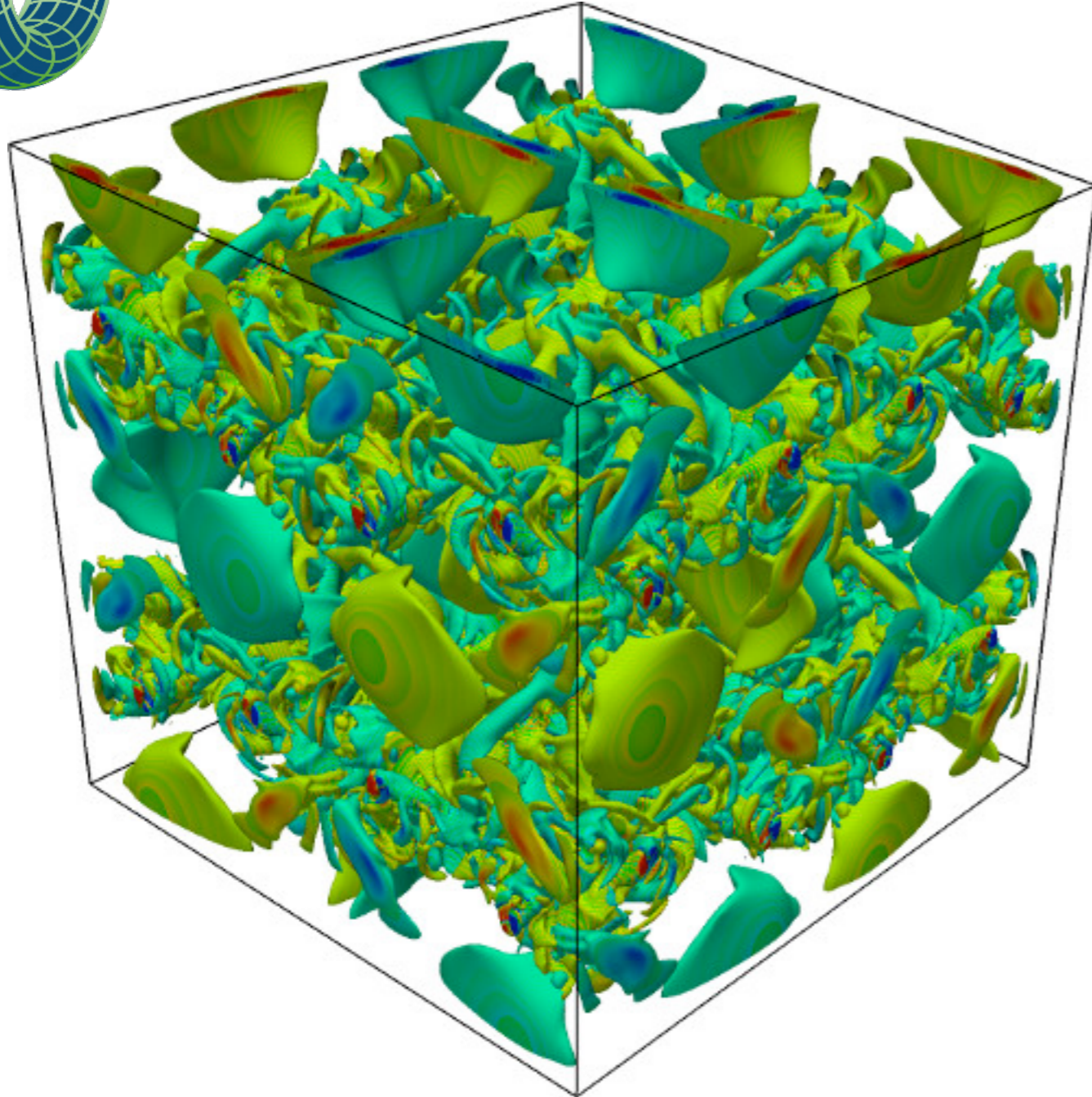
[GitHub](#) [SageMath](#) [Pari/GP](#) [Magma](#) [Python](#)

Maths project - general help (especially with databases)
[LMFDB.org](https://www.lmfdb.org)

OPS (Computer Science)

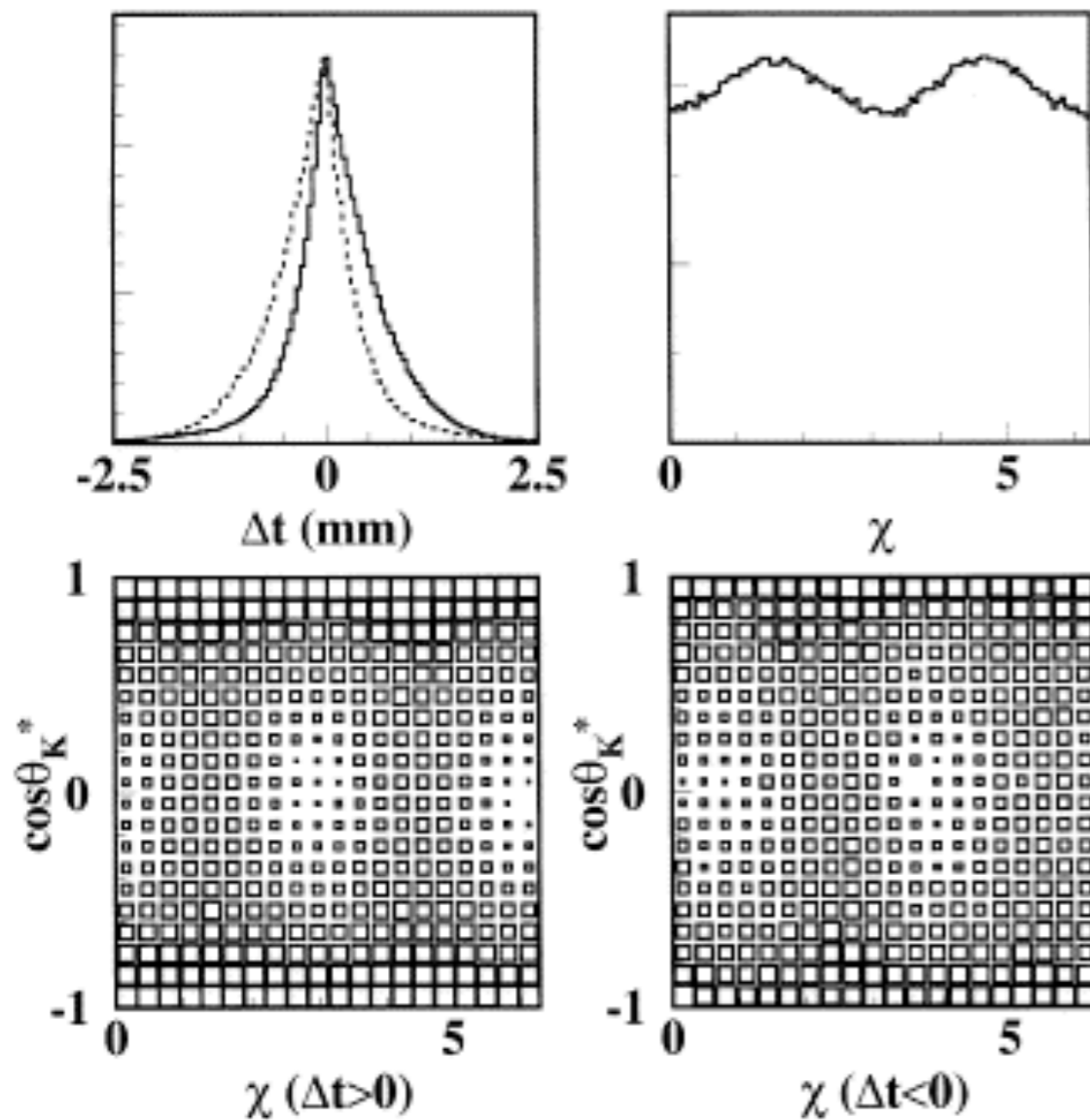


OP-DSL



- Reimplement an engineering CFD code from Nottingham using the OPS Domain Specific Language
- Allows single code to run on GPU, local CPU or cluster

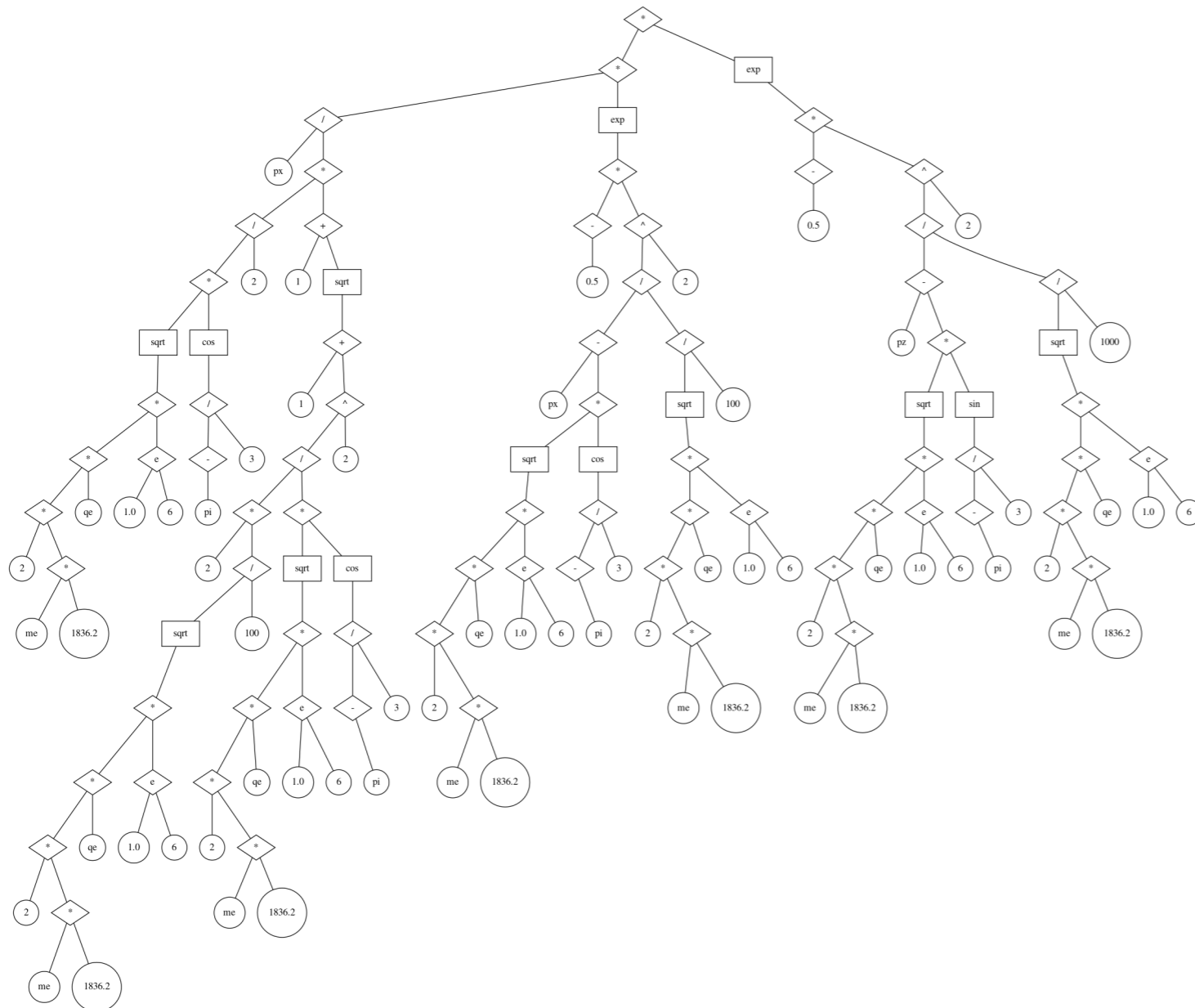
EVTGen (Particle Physics)



- Monte-Carlo event generator for particle physics
- Want to run “task” parallel jobs - split tasks up over processors
- Make core code thread safe but not threaded

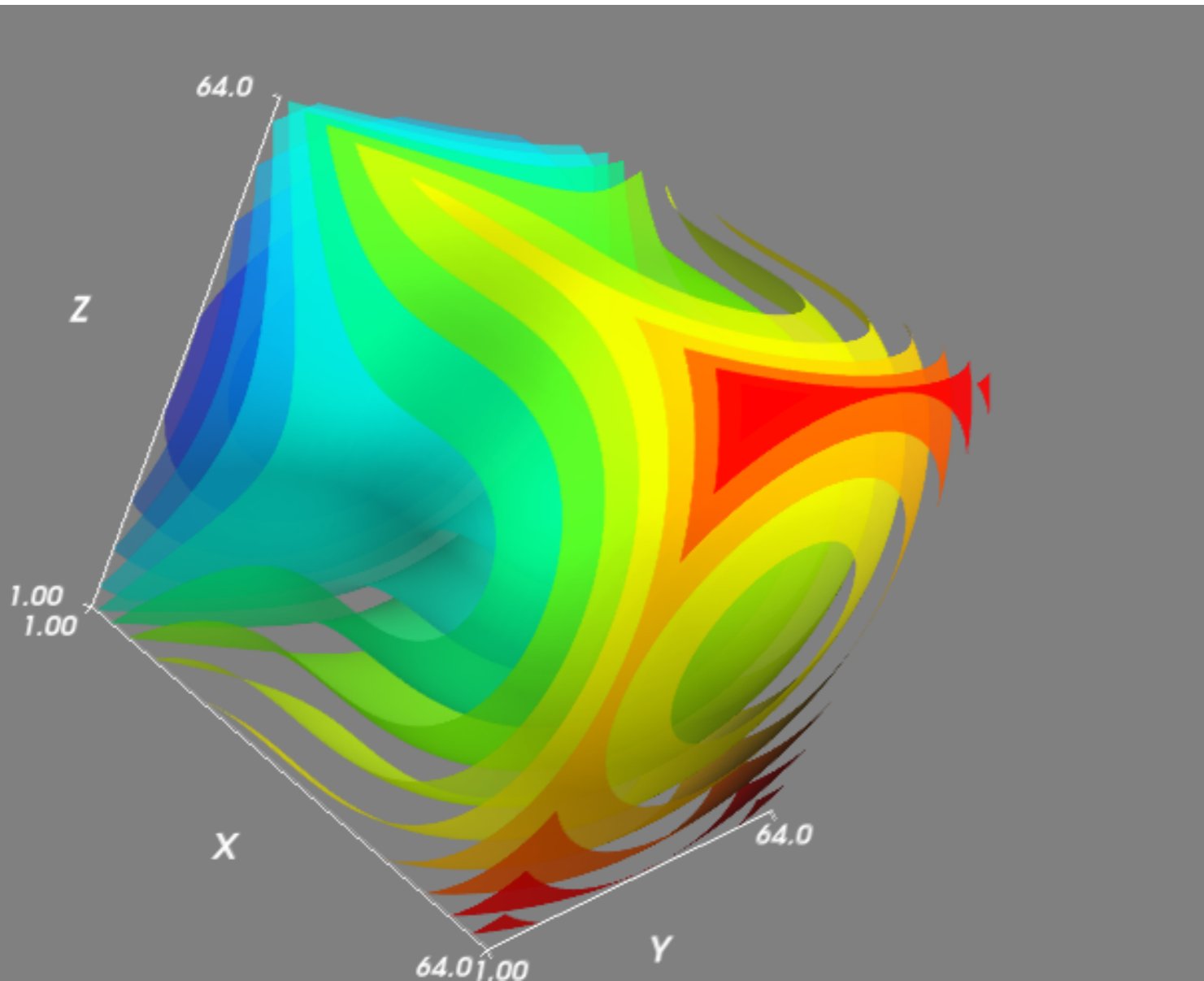
EPOCH (CFSA)

EPOCH



- We applied for ARCHER eCSE funding
- Improved data structures
- Enhanced maths expression parser
- <https://github.com/csbrady-warwick/EIS-2>

PX913



- PX913 -
“Introduction to scientific software development”
- Taught as part of Heterogeneous Systems DTC but about 20% of people who’ve taken it are not Hetsys

Training

- Various generally available training courses
 - Accelerating Python, Introduction to Software Engineering
 - HPC For Data Science
 - Advanced topics in MPI
 - Everything in between
- Delivered out of term time (by video at the moment)
 - Usually 1-2 sessions in both Easter and Christmas Breaks

Other things

- General support by email, video and in person
- Wednesday video drop-in “mini-seminars” live on Youtube
- <https://warwick.ac.uk/research/rtp/sc/rse/training/dropin>
- Members of national and international committees on “things”