

TARDIS

Exploring supernovae made easy



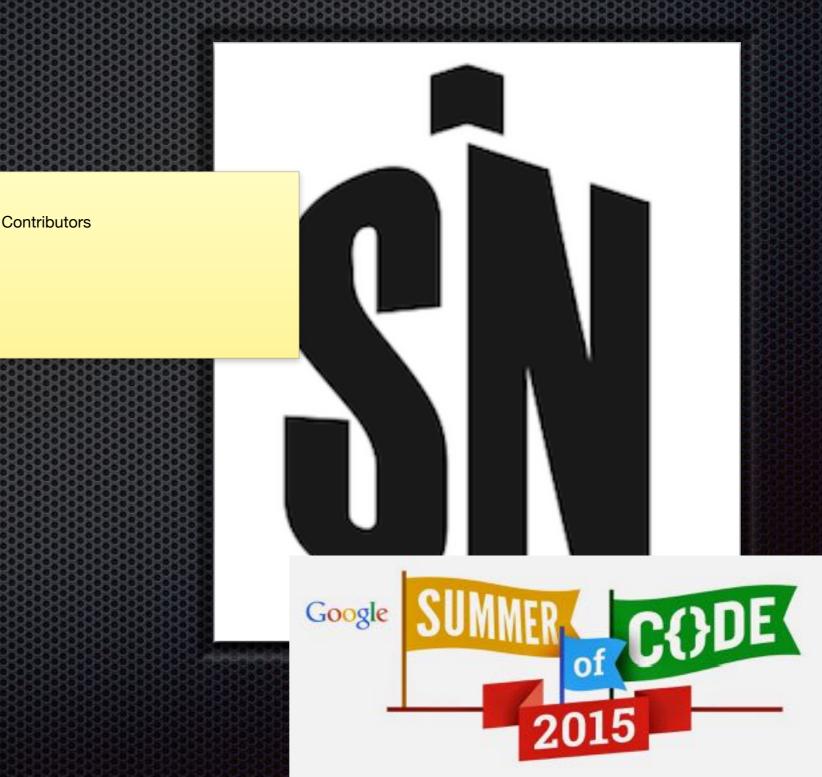
a radiative transfer code, an open source community, and an interdisciplinary collaboration

- W. E. Kerzendorf
- ESO Fellow
- European Southern Observatory on behalf of the collaboration



Ulrich Noebauer Stefan Lietzau Stuart Sim Vytautas Jančauskas **Fotis Tsamis Aoife Boyle Frederik Beaujean Hans Eggers Talytha Barbosa Christian Vogl** Adam Suban-Loewen Gaurav Gautam Sourav Singh Maryam Patel Vaibhav Ujjwal Wahi Kevin Yap

The TARDIStas



OpenHub has analysed our code and says:

In a Nutshell, tardis-sn...

...has had <u>2,685 commits</u> made by <u>38 contributors</u> representing <u>11,938 lines of code</u>

...is mostly written in Python

with an average number of source code comments

...has <u>a well established, mature codebase</u> maintained by <u>a large development team</u>

with <u>decreasing Y-O-Y commits</u>

...took an estimated 3 years of effort(COCOMO model)

starting with its <u>first commit in December, 2011</u> ending with its <u>most recent commit 4 days</u> ago

How does it work?

TARDIS 1D Supernova Model

Each Shell (in velocity space) Density Abundance Temperature

homologous expansion v = r / t

outer boundary

inner boundary no energy creation in envelope!

TARDIS Simulation

pick a time pick output luminosity

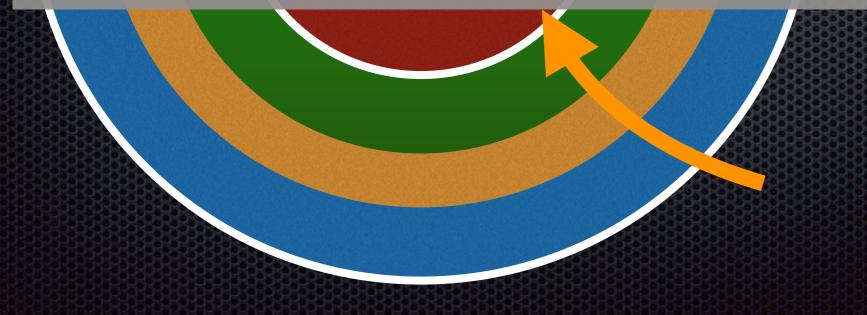
TARDIS 1D Model

TARDIS solves plasma states

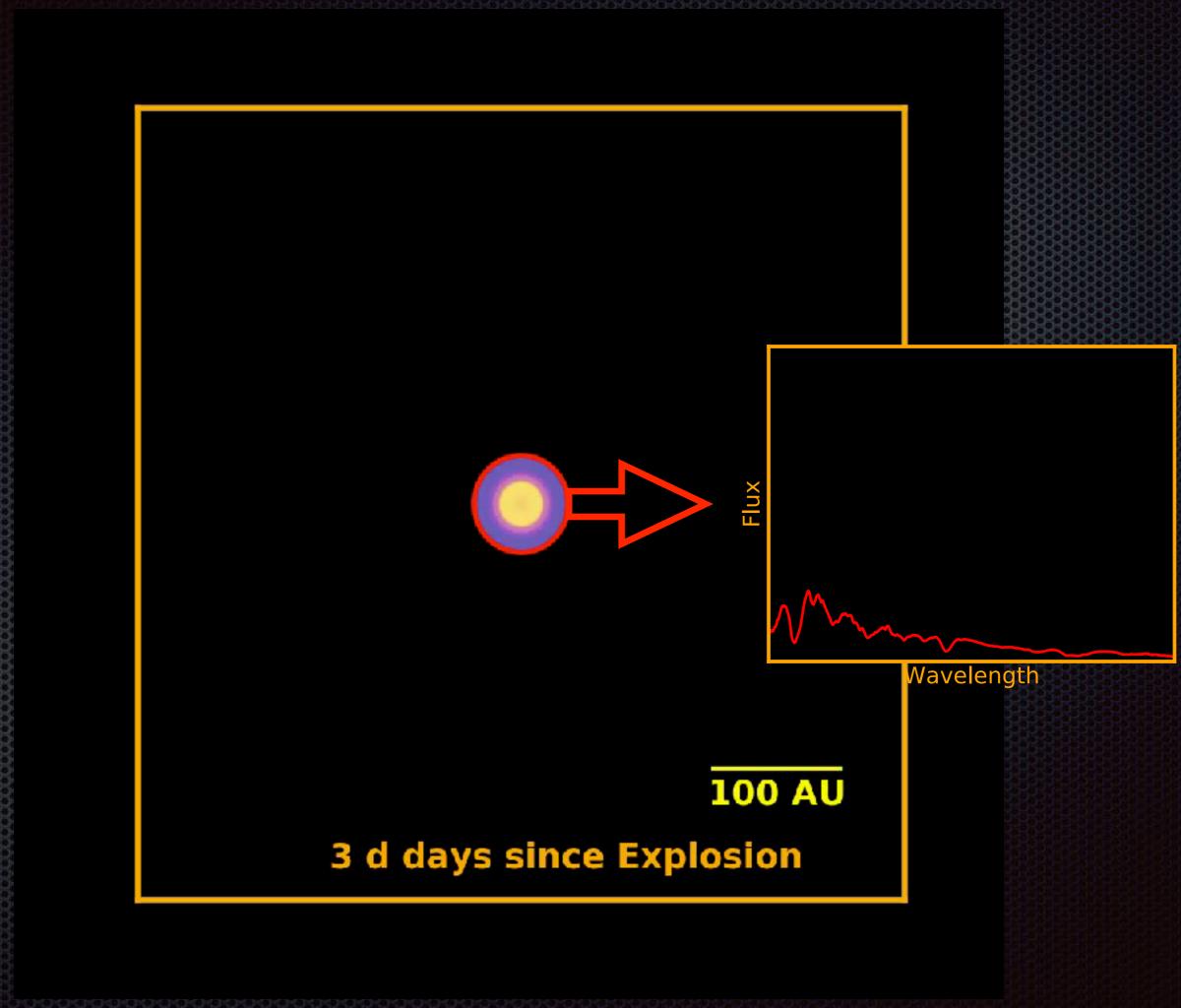
Model is updated: too luminous - colder black body too faint - hotter black body

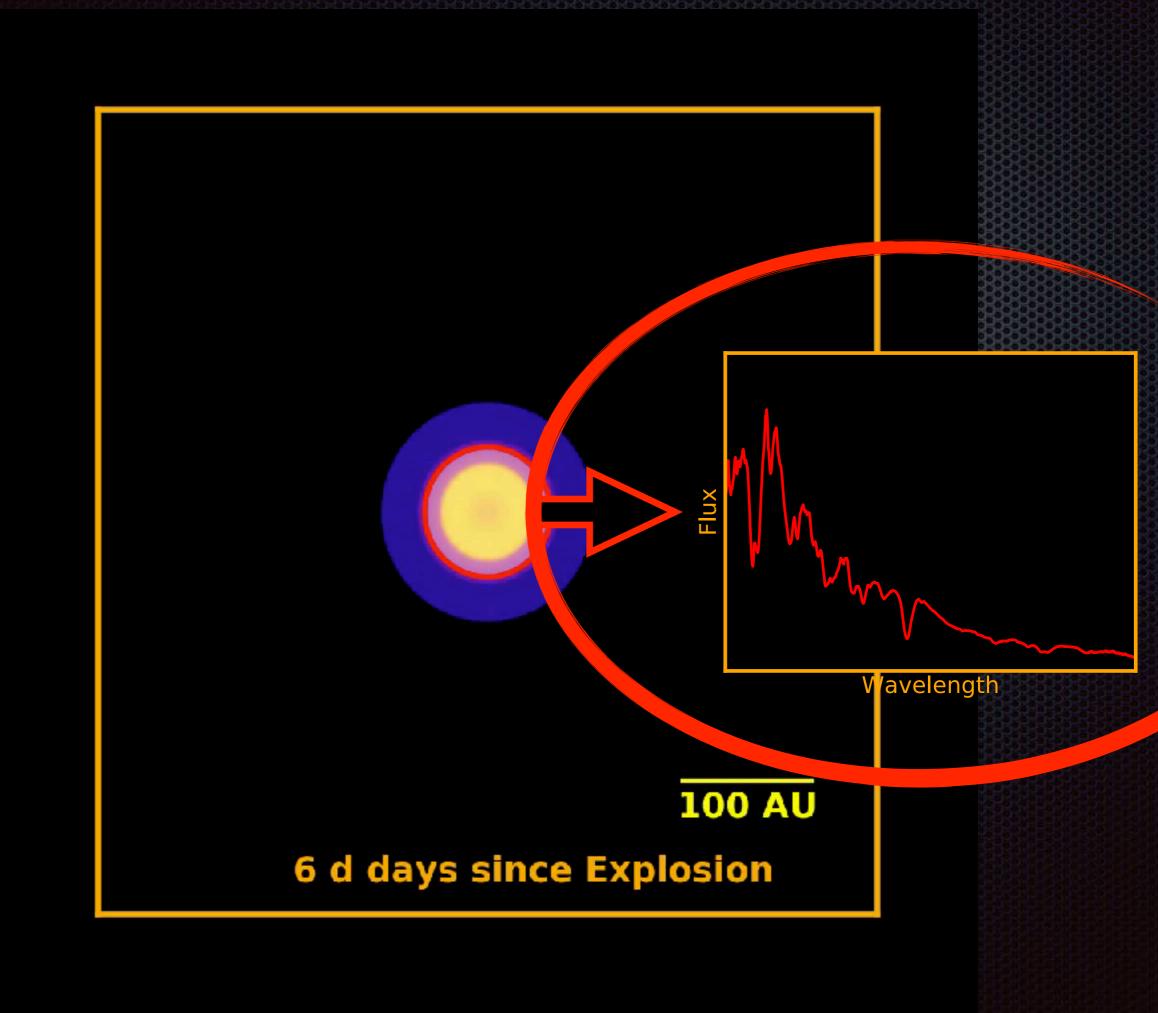
ecarlo starts

update of temperature/dilution factor



Spectrum estimators: e.g. rad. Temperature





Best practices for a scientific code (IMHO)

which I unfortunately sometimes ignored

Best Practices quickest way from idea to product

- hack things together
- don't use anything that will slow you down (can be version control, unit tests, etc.)
- don't worry you will likely rewrite
- specifically speed is not an issue (in most cases)

We should forget about small efficiencies, say about 97% of the time: premature optimization is the root of all evil

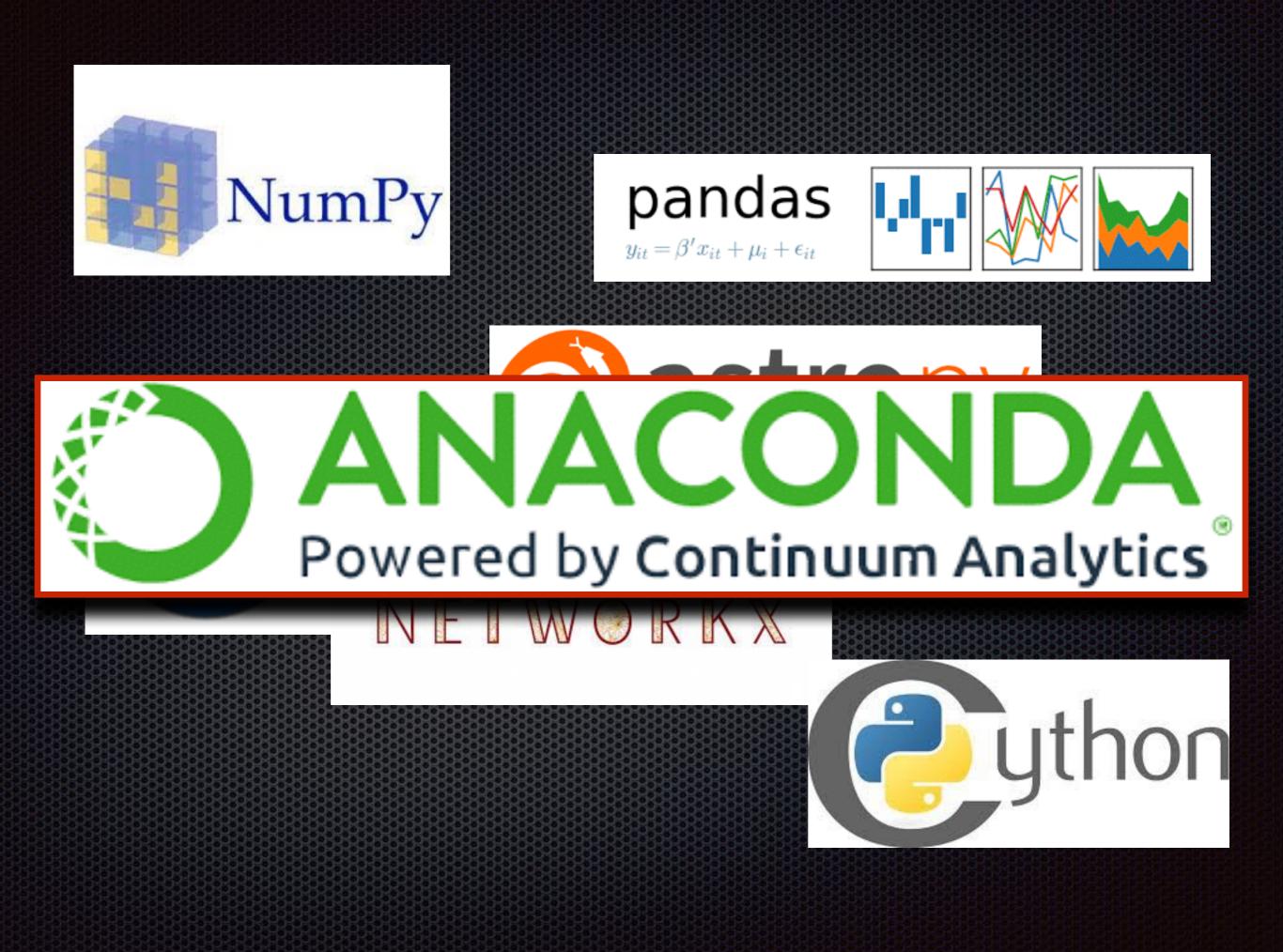
Donald Knuth



Don't Reinvent

Reuse!

Best use for old wedding dress: snow hunting camo



Best practices Building a community





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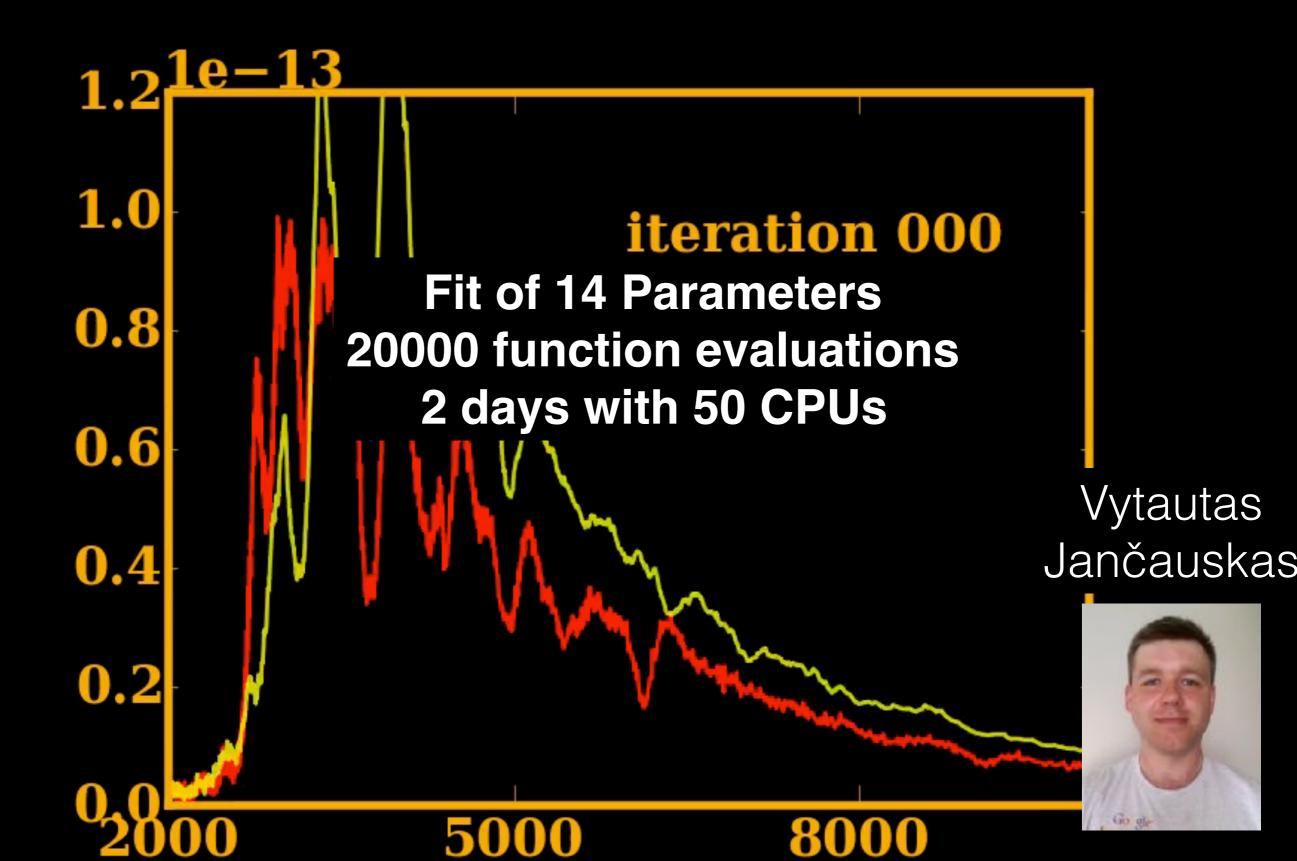


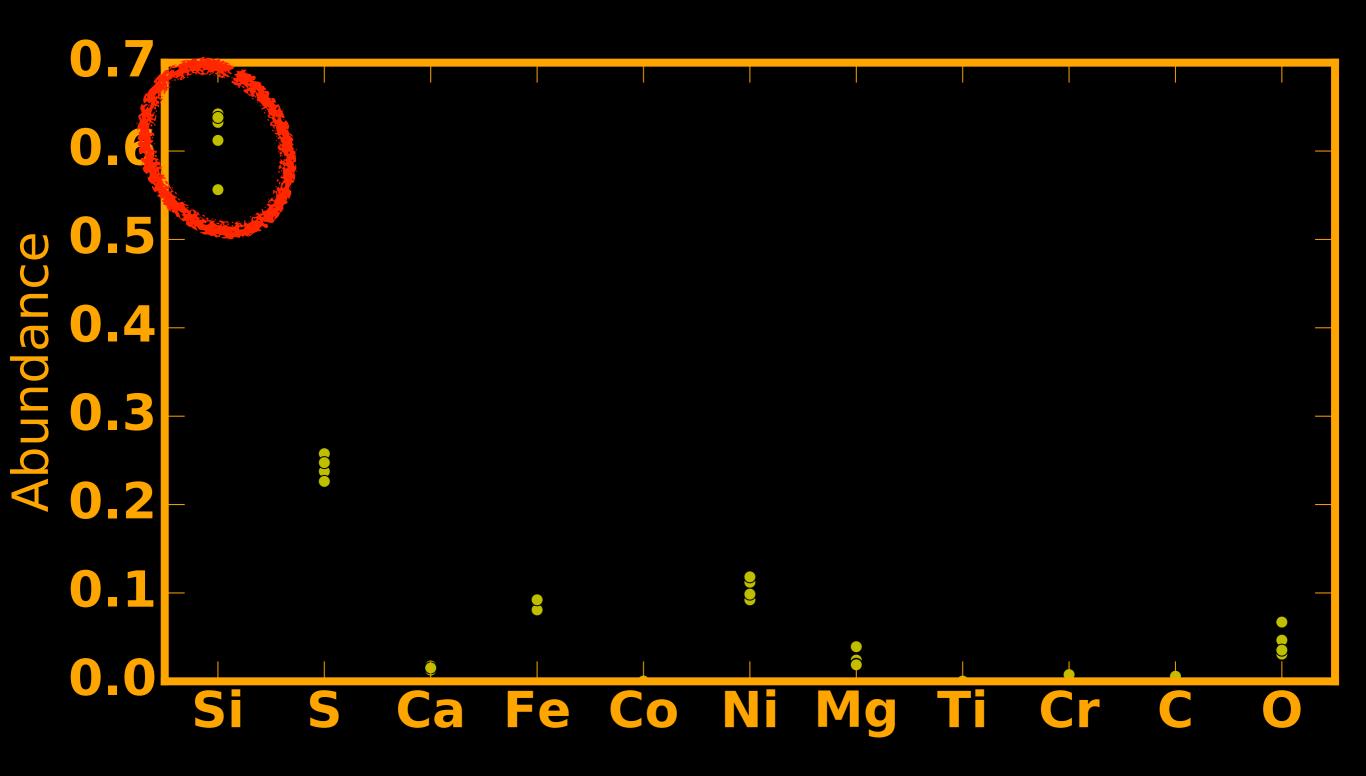
Best practices

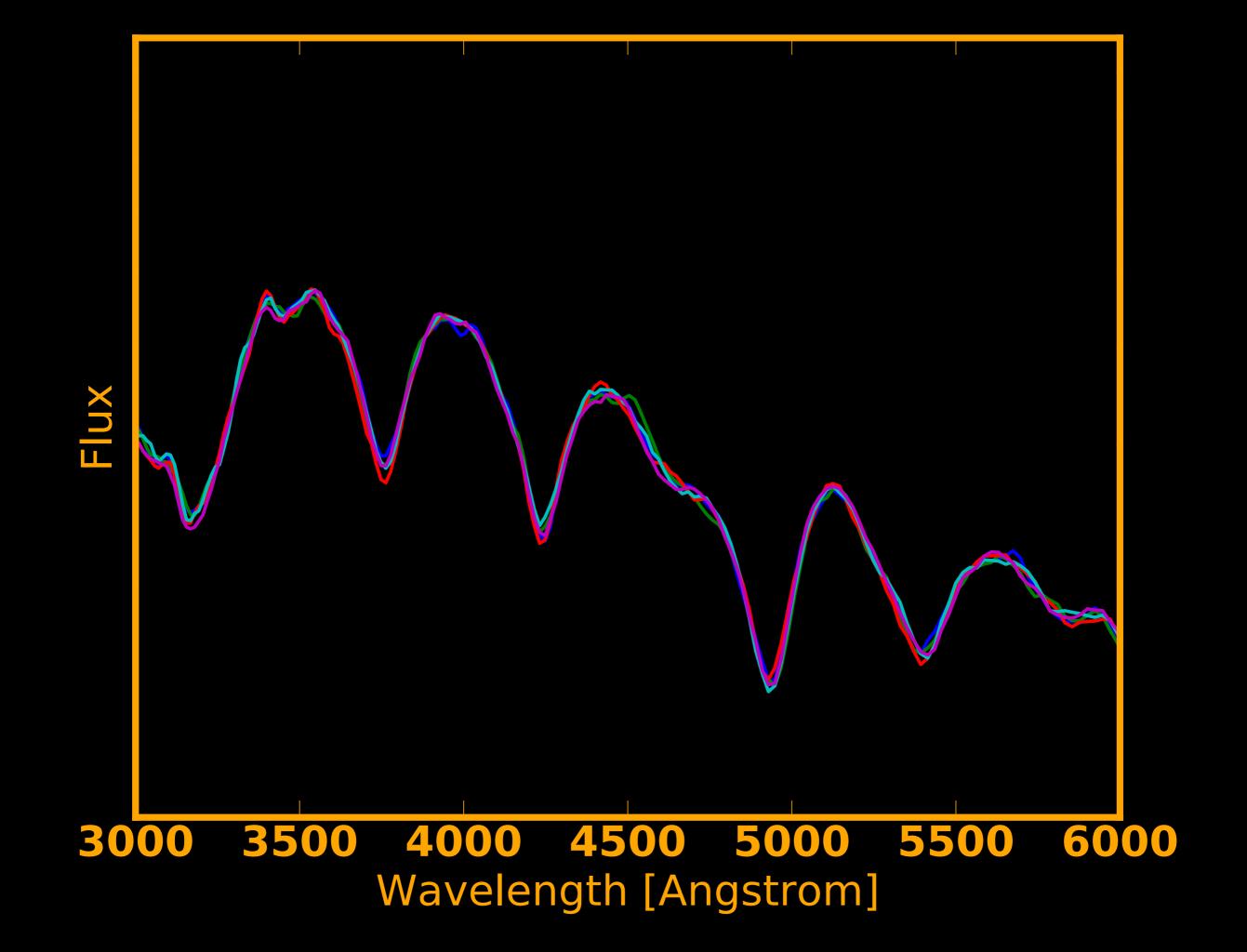
Building an interdisciplinary community

Computer scientists

Optimizer - Differential Evolution



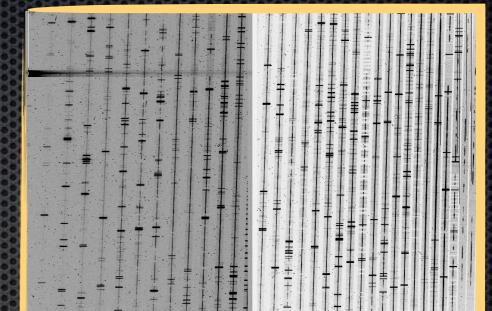




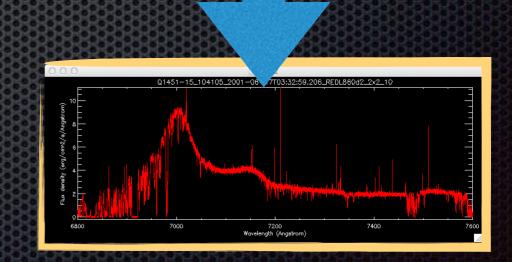
Statisticians

Know your limits!

- What carries the biggest uncertainty?
- What precision do you need to distinguish between models?
- A statistician will be disgusted at first!



Raw frame from the UVES high-resolution spectrograph



Processed data: it's an accreting black hole in the infant Universe!

Best practices Credit - an unsolved problem

Value of you/your code

- Peer reviewed Journal Article!
- ASCL
- Software is difficult many contributors constantly changing

ZEADOO

Developing simulation codes

- Science discovery needs to be the key driver (everything else is secondary)
- Only write code that doesn't exist anywhere else
- Many of the software engineering techniques are geared towards team development - not always applicable

Thank you