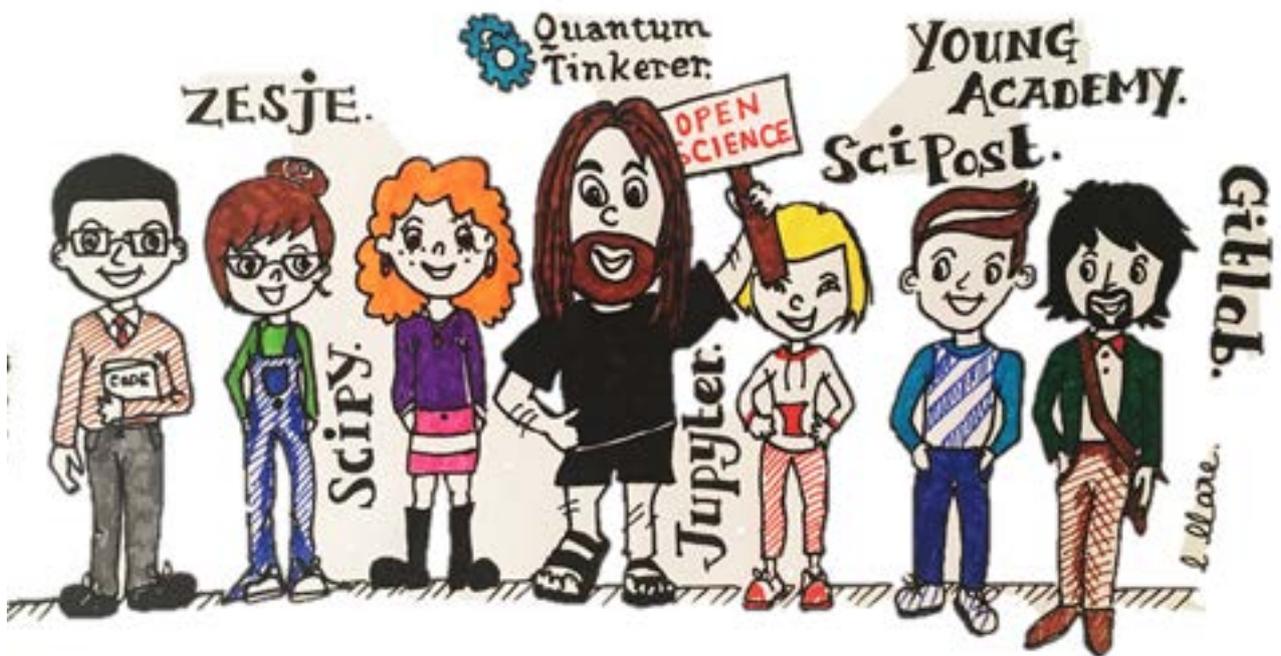# Starting small and thinking big: A Quantum Tinkerer's quest to mentor Open Science.

We hear from Data Champion and Associate Professor in Quantum Nanoscience, Anton Akhmerov, about his journey towards becoming an ambassador for Open Science at TU Delft.

An individual who volunteers their discipline-specific expertise, promotes FAIR data principles and advocates proper research data management.

An individual who uses their passion for knowledge exchange and their desire to build a collaborative and researcher-led community to drive the uptake of Open Science within their faculties and departments.

By definition, Anton Akhmerov leads by example as an outstanding TU Delft Data Champion.

Inspired by open-source

Akhmerov is a theoretical physicist at the Kavli Institute of Nanoscience and QuTech at TU Delft. His expertise in quantum mechanics and nano-superconductors involves numerical simulations to explore complex phenomena, such as topological quantum computation. His research uses various open-source software, including SciPy (a Python-based software for STEM subjects) and Jupyter (a project that exists to develop open-source software, standards and services for interactive computing).

Akhmerov explains why open-source software is integral to his work. "Many of my ideas aren't radically new; I see something good and I want to make it even more awesome." He adds, "Sharing code increases the impact of such work, and makes it possible to work on topics as a community." To this end, we learned about Akhmerov's contribution to Jupyter whereby he created a library for incorporating code output in documentation using Jupyter-Sphinx together with collaborators. His example demonstrates how incremental improvements can take place through open-source. He also feels compelled to make his research open for altruistic reasons. "Since my software development is achieved within the open-source domain, it seems natural to share my code so that others can use it."

Starting small

Starting small with his ambitions, Akhmerov began by perpetuating his culture of sharing amongst colleagues of the Quantum Tinkerer research group at TU Delft. After back-and-forth discussion about how they could make their research more open, it was agreed that the group's work in progress would be shared internally on their Kwant Gitlab server whilst finalised code would be published openly on zenodo.

Caption: Anton Akhmerov and his colleagues of the Quantum Tinkerer research group at TU Delft

Thinking big

In collaboration with another Data Champion Gary Steele, Akhmerov worked to develop and implement an Open Data Policy to engender a culture change across the entire Quantum Nanoscience Department. The policy provides guidelines on preparing and openly publishing data for the department but is to be adopted across the Faculty of Applied Sciences in the hope that it will eventually become the norm at TU Delft.

He also actively engages with the wider scientific community to stimulate a discourse about making research data and software open. His talk, 'Time to share is now', was delivered at the Data Champions kick off meeting in December 2018 to emphasise the importance of software in contemporary research. He was also an author of the presentation, 'Making Research Software a First-Class Citizen in Research', that was delivered at a meeting with The Netherlands Organisation for Scientific Research (NWO) in March. The presentation advances the idea that if we are to produce transparent, reliable and reproducible research in the name of Open Science, then publications, data and software must be treated on equal footing at the policy level.

The Spirit of Secrecy

Encouraging researchers to make their software open isn't easy. "Many researchers see sharing code as a radical idea and may object for several reasons; they may feel like their code is invaluable to others or that it takes too much time to clean up and make readable. Alternatively, they may have dedicated a lot of time to develop a piece of code that gives them a competitive advantage and, therefore, feel reluctant to share it." Says Akhmerov.

Whilst he understands such objections, his personal perspective is somewhat different. "I don't particularly appreciate this spirit of secrecy and I hope the prominence of this viewpoint will eventually diminish." He claims, "Researchers who want to publish their papers but refuse to publish their code aren't helping to solve the problem of reproducibility."

Reviewers, rethink! Do something for Open Science that requires zero effort.

Akhmerov realised that he could do something to help solve the problem with no extra effort. As a reviewer, he began requesting all of the underlying data and code for each paper that he reviews. "It's the responsibility of the reviewer to ensure that the publication is based on sound results. By examining the data and code used in the paper, one can verify whether or not the findings are indeed true." His article, 'I need your data, your code and your DOI', relays the message that reviewers are in a position of power and can mentor Open Science by ensuring quality standards are met.

He is a member of the editorial board of the New Journal of Physics, and more recently, SciPost; an online, open access, community-run journal managed by scientists. Akhmerov highlights the benefits of SciPost's guiding principles and is in favour of making the peer-review process more visible to the scientific community. "SciPost assigns each manuscript review a DOI, meaning that the review process can be witnessed and is no longer confidential. This leads to a stricter peer-review process as reviewers are held accountable. What's more, reviewers can be credited for their time and effort invested in evaluating submissions." Using publication portals where public-funded science is freely and openly accessible to anyone is an effective way to advance Open Science worldwide.

Open Education

Akhmerov leads by example as a mentor for Open Science. He teaches the undergraduate Solid State Physics course at TU Delft and has created publicly open online lectures notes with simulations. The source code is openly available so that students can use and modify the lecture material. He explains how this aids the learning process, "Students are encouraged to engage with the lecture material. Since they can access the code, they can correct it, develop it and can even design their own lectures." Akhmerov's lectures are a great example of self-directed, researcher-led learning. Moreover, making lecture material open means that it can be used by many course lecturers simultaneously, making teaching more efficient. To this effect, he also conducted a Massive Open Online Course (MOOC) to educate thousands of students about topology in quantum mechanics.

In collaboration with software developer, Joseph Weston, Akhmerov developed 'Zesje', a web app where written exam manuscripts are scanned and systematically graded on a question-by-question basis. The app, named after the Dutch term 'zesjecultuur' which means 'Grade C-', was devised to streamline the grading process by assessing exam manuscripts electronically, rather than on paper. Akhmerov came up with the idea when faced with the daunting task of marking around 300 physics undergraduate exam papers. "Whilst an examiner may have a predefined idea of how they want to grade exam answers, it's extremely difficult to ensure consistency when assessing a large cohort of students on paper." He adds, "Zesje saves time and

effort. An examiner can mark more consistently and the grading can be distributed throughout the entire course team." Akhmerov's enthusiasm for low effort exam grading has spread across the university. Now, around 20 courses use Zesje, including those within the Computer Science department that comprises approximately 900 students. Akhmerov was awarded the 2018 Delft Educational Fellowship for his innovation.

Dedicated to advocating good practice in open-source software development, Akhmerov organised a one week course, inspired by Software Carpentry, to teach basic programming skills to PhD students of the Casimir Research School.

Future ideas

As a member of the Young Academy, he is part of a dynamic team of scientists who share a broad interest in science practice, policy and communication. His group project within the academy aims to reduce the carbon footprint of academic travel through the organisation of virtual conferences. "Aside reducing carbon footprint, online conferences have several advantages over offline conferences," says Akhmerov. "They reach a broader audience and are more inclusive since they accommodate individuals who are limited by funding or prohibitive travel logistics. Online conferences are also less administrative, easier to organise and cheaper to host." We look forward to hearing how his idea to run virtual conferences at TU Delft progresses.

We are truly inspired by the positive energy and enthusiasm Akhmerov brings to TU Delft as a Data Champion and mentor for Open Science. Learn more about his latest ideas and perspectives by following his blog and twitter accounts; @AkhmerovAnton and @QuantumTinkerer, to keep-up-to-date!

Citation

This showcase is a selection from the following publication:
Clare, Connie. (2019). The Real World of Research Data [Book]. Zenodo. http://doi.org/10.5281/zenodo.3584373.