

MoSaiQC | ITN

Modular Systems for advanced integrated Quantum Clocks

D4.2 Report on Outreach activities

Project acronym: MoSaiQC
Project full title: Modular Systems for Advanced Integrated Quantum Clocks
Grant agreement no.: 860579

Due Date:	Month 54
Delivery:	Month 54
Lead Partner:	UvA
Editor:	Florian Schreck (UvA) Ineke Brouwer (UvA, PM)
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Dissemination Level:	PU
Status:	Final
Approved:	Yes
Version:	V1.0



This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under the Marie Skłodowska-Curie grant agreement No 860579 (MoSaiQC).
This deliverable reflects only the author's view and the European Commission is not responsible for any use that may be made of the information it contains.

DOCUMENT INFO

Date and version number	Author	Comments
v0.1, 27/6/2024	Ineke Brouwer (UvA, PM)	Template document
v0.2, 9/7/2024	Ineke Brouwer (UvA, PM)	First draft
v0.3, 30/7/2024	Ineke Brouwer (UvA, PM) with input from supervisors	Second draft, for internal review
v1.0 22/8/2024	Ineke Brouwer (UvA, PM) with input from internal reviewer Yeshpal Singh (UoB)	Final submitted version

GLOSSARY

CEO	Chief Executive Officer
D	Deliverable
DoA	Description of Action
ESR	Early Stage Researcher
GA	Grant Agreement
MOOC	Massive Open Online Course
R&D	Research and Development
STEM	Science, Technology, Engineering and Mathematics
TUW	Technical University Vienna
UCPH	University of Copenhagen
UIBK	University of Innsbruck
UMK	Nicolaus Copernicus University in Torun
UoB	University of Birmingham
UvA	University of Amsterdam
WP	Work Package

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Executive summary

This report summarises the outreach activities that were undertaken as part of the MoSaiQC project. As per the Grant Agreement, outreach was part of WP4 - Dissemination and Outreach. Key elements of the outreach strategy of MoSaiQC were:

- ***Project website and social media***
- ***Educational outreach***
- ***Job fair and industry day***
- ***Further outreach activities***
- ***Open days and similar events***
- ***Collaboration with graphical artist***

Although many outreach events were cancelled, postponed or moved to an online setting due to the Covid-19 pandemic, most activities have been performed in line with the grant agreement.

1 List of contributors

Name	Organisation	Role
Ineke Brouwer	UvA	Project Manager
Florian Schreck	UvA	Deliverable editor
Yeshpal Singh	UoB	Internal reviewer

2 Introduction

This report summarises the outreach activities that were undertaken during the MoSaiQC project. As per the Grant Agreement, outreach was part of WP4 - Dissemination and Outreach. This WP had 6 objectives:

- **Objective 1:** Equip ESRs with the tools to engage with society (influencers, educators, the media, and the general public) through a variety of mechanisms, including practical skills for presenting to different audiences, designing successful outreach projects and programmes, and media skills.
- **Objective 2:** Develop open and accessible online resources, promoting engagement of society with MoSaiQC and its scientific goals and activities.
- **Objective 3:** Develop and deliver outreach activities (e.g. lay articles in non-specialised public addresses, activities at science fairs, public talks etc.), open labs for various occasions.
- **Objective 4:** Communicate the achievements of MoSaiQC to the Quantum Technology and timing community.
- **Objective 5:** Publish results in high-impact journals and present lectures or posters at conferences and seminars.
- **Objective 6:** Deliver the selected MoSaiQC MOOC.

As outreach is defined as communication of scientific knowledge to those outside the traditional academic community, it is linked to objectives 1, 2, 3 and to a smaller extent objective 6. Dissemination is linked to objectives 4, 5 and 6 and activities related to these objectives (e.g. organisation of a Summer School, Spring Schools, Autumn Schools and QESR, an ESR-led event on quantum technologies for precision measurement) are not discussed in this report.

To reach objective 1, 2 and 3 as described above, several actions have been taken during the lifetime of the MoSaiQC project:

- Project website and social media (section 3)

- Educational outreach (section 4)
- Job fair and industry day (section 5)
- Further outreach activities (section 6)
- Open days and similar events (section 7)
- Collaboration with graphical artist (section 8)

A specific description of each action and its outcomes is provided in the sections below. In addition, a discussion on sustainability and follow-up opportunities is provided (section 9).

3 Project website and social media

Online communication was the primary channel to engage with all different MoSaiQC audiences. All relevant information is presented on the website (https://www.mosaiqc.eu/). The website aims to describe the focus and goal of the MoSaiQC project, the project partners, the ESR projects, contact information and to advertise and document all project and outreach activities. It allows visitors to download the public deliverables. The website is predominantly targeted at a professional and scientific audience and is maintained by the PM. For more details regarding the website, please refer to Deliverable D4.1 - Project Website.

Besides the website, MoSaiQC has been active on social media through the Twitter account of Florian Schreck. Tweets were often retweeted by iqClock (GA 820404), Quantum.Amsterdam and QuSoft.

4 Educational outreach

A number of MoSaiQC supervisors is actively engaged in teaching of undergraduate students at the different partner universities (UvA, UoB, TUW, IUBK, UMK, UCPH), leading to direct educational input on atomic clocks, quantum technology for precision metrology, laser technology and other related topics. ESR9 presented his research results in a dedicated web-presentation/discussion session to undergraduate students from the Atomic Physics course at UCPH.

Finally, the MoSaiQC massive online open course (MOOC) was developed and is available on the MoSaiQC website (https://www.mosaiqc.eu/mooc.html) and YouTube channel (https://www.youtube.com/channel/UCQOWaEymCUcjkDxj8OStj0A). This course consists of a collection of recordings of lectures from various MoSaiQC events and is available as free-to-use content. It is aimed at junior researchers and can be used to educate undergraduate, master-level and PhD-level students on the topic of optical atomic clocks and all physics and technology needed to make new and better quantum clocks. For more information, please refer to Deliverable D4.4 - MoSaiQC MOOC.

5 Job fair and industry day

The Grant Agreement describes a job fair and industry day. After discussions with MoSaiQC supervisors and ESRs, it was decided that, for both the ESRs and MoSaiQC outreach purposes, it preferred to attend existing events with a large number of visitors and thus a larger exposure, rather than organising a separate event with a much more limited reach. Therefore, ESRs were invited to 2 separate events:

1. All ESRs were invited to the iqClock Industry Day that took place on 24 March 2022.
2. The ESRs visited Munich in the week of June 26-30, 2023 for 3 events in that week:
    - The Conference on Lasers and Electro-Optics (CLEO Europe) that took place in Munich from June 26-30, 2023
    - The Trade Fair Laser World of Photonics that took place in Munich from June 27-30, 2023

- A company visit to TOPTICA (Munich) on June 27, 2023.

Combining these events in a single week in Munich allowed ESRs to attend (and, for some ESRs, present at) the scientific conference CLEO Europe. At the same time, they were able to interact directly with key players from application, research and technology at the many exhibitions at the Laser World of Photonics Trade Fair. Moreover, a company visit to TOPTICA was organised as a dedicated MoSaiQC event. During this afternoon ESRs learned more about the R&D and career possibilities at TOPTICA.

6 Further outreach activities

Besides the efforts described in section 3-5, 7 and 8, a number of other outreach activities were undertaken during the project lifetime:

- All ESRs took part in the transferable skills training “Pitching your Research” offered by Hertz training for scientists. As part of this course, ESRs were taught how to present their research to the general public.
- Several ESRs took part in local outreach events such as school visits, community organisations, national science fairs (e.g. the annual British Science Festival) in order to enhance public understanding of science.
- Florian Schreck (UvA) wrote a popular scientific article entitled “Continue Bose-Einsteincondensatie” which appeared in the “Nederlands Tijdschrift voor Natuurkunde” (https://www.ntvn.nl/) in May 2024. The article is advertised here: https://www.ntvn.nl/2024/5/continue-bose-einsteincondensatie/.
- Florian Schreck (UvA) was awarded the FYSICA prize (https://iop.uva.nl/content/news/2024/02/florian-schreck-wins-physica-prize.html) on April 12, 2024. The prize was awarded at the annual FYSICA conference (https://www.ntvn.nl/2024/3/fysica-2024/), where he also gave a plenary lecture addressed at the general public about his work.
- Florian Schreck (UvA) took part in a discussion about quantum technology during the UvA University Day 2023.
- Florian Schreck (UvA) together with Folia, the media outlet for students and employees of the University of Amsterdam, produced a video explaining what an atomic clock is. The video is suitable for the general public for both adults and children. The video can be found here: https://www.youtube.com/watch?v=ryV922Jfqbg
- UvA’s laboratories were photographed by a professional photographer. The photopgrahs are since then used by Quantum Delta NL outreach (e.g. on the QDNL website https://quantumdelta.nl/catalyst-programs/quantum-sensing-applications).
- UvA’s labs were visited by French president Macron, King Willem-Alexander of The Netherlands, a CEO of Samsung and many others. This led to many news items, from newspaper articles to international TV (press release: https://www.uva.nl/shared-content/uva/en/news/press-releases/2023/04/king-willem-alexander-and-president-macron-are-given-a-quantum-tour-of-the-uva.html#:~:text=Universiteit%20van%20Amsterdam-,King%20Willem%2DAlexander%20and%20President%20Macron%20are%20given,quantum%20tour%20of%20the%20UvA&text=On%20Wednesday%20morning%2C%2012%20April,of%20Science%20with%20a%20visit.).
- ESR9 and ESR10 have arranged a large number of laboratory tours for national and international visitors, as well as ambassadors and foreign ministers from a range of countries (e.g. Anthony Blinken from USA: https://nbi.ku.dk/nyheder/det-sker-paa-nbi/stor-amerikansk-interesse-for-dansk-forskning-i-kvanteteknologi/) at UCPH.

- Related to ESR12 being awarded the "For Women in Science" scholarship in November 2023, ESR12 was interviewed about her work. The interview is available at https://www.youtube.com/watch?v=Jr7OneQVYcM.

7 Open days and similar events

MoSaiQC outreach is built as much as possible onto existing events that allow interaction with members of the public. MoSaiQC ESRs and supervisors were actively involved in open lab/institute days, school days and Girls days. Specifically at UCPH, we participated in the Girls Day in Science on 6 September 2021 and again on February 7th, 2024. This nationwide day in Denmark is annually visited by around 1400 girls with an interest in science and technology. In small groups, the girls were able to visit the labs, talks, demonstrations and discussions of possible projects. At UvA we participated in the Girls Day in April 2021 and April 2022. During these events, girls from several high school science classes visit companies and institutes for an afternoon of science. At UvA, the girls make their own hologram, learn about clocks and timekeeping, and get to talk to female scientists to get an impression of a career in academia.

These activities provide excellent opportunities to show the general public research activities and to give an impression of the way we work and help to ground the public perception of science. The main goal is to excite young people about science. Specifically, we have taken advantage of existing projects such as Pint of Science (and international activity with a very wide reach) and the Waag Society, based in the Netherlands. Their events often take place in very public settings including cafes and bars, which exposes new audiences to the importance of quantum metrology and timekeeping.

8 Collaboration with graphical artist

At UoB, a new route to public engagement was explored involving a graphical artist (http://www.trappist.one/#stories), to present research in the form of e.g. graphic novels. This approach is complementary to the more conventional outreach approaches described in sections 2-7. Specifically, as part of the iqClock project (GA 820404), a comic book “Athena and the tortoise” was developed. During MoSaiQC, this comic book was distributed among high school students during local outreach events at the different partner institutions.

9 Follow-up and sustainability

Outreach activities related to the results of MoSaiQC will be continued after the project ends. Ideally, this would be embedded in follow-up projects such as AQuRA (GA 101080166). The outreach strategy for AQuRA includes, among other items, a Quantum Technologies Teaching Kit, how-to videos in optics building tasks for young researchers and a STEM ambassadors program. Moreover, we have submitted a proposal for a follow-up Doctoral Network in the HORIZON-MSCA-2023-DN-01 call which was unfortunately not funded. Currently we are preparing a follow-up proposal for the HORIZON-MSCA-2024-DN-01 call. Once this proposal or a similar proposal will be funded in future, the outreach strategy will build on the outreach strategy that was developed during MoSaiQC.

Besides continued outreach in follow-up projects, continued outreach will also take place independent of these future projects. Outreach is a continuous activity at all MoSaiQC partner institutions and the results of MoSaiQC will naturally become a part of those activities. Moreover, within MoSaiQC, 16 ESRs have been trained both in the field of optical clock technologies and in communication strategies. We expect that many of the ESRs will continue to work in the field of optical clock technology and therefore use this combination

of skills to further disseminate the MoSaiQC results to the wider community. Moreover, the MoSaiQC website will continue to exist and be hosted by the UvA.

10 Deviations from the Description of the Action

Most outreach efforts were delivered as described in the DoA. However, as the Covid-19 outbreak occurred during the MoSaiQC project, it affected many of the project activities including outreach activities. Almost all outreach activities were cancelled, postponed or moved to an online setting. For MoSaiQC, we constantly maintained our online presence and were represented at both online and in person outreach activities whenever possible.

In addition, we list below the specific deviations from the DoA:

- Rather than creating separate social media channels for MoSaiQC, we have chosen to use existing channels (of Florian Schreck and the iqClock (GA 820404) project). These channels already had a significant amount of followers, increasing the visibility and audience for MoSaiQC outreach. As an added benefit, these channels will continue to remain active beyond the lifetime of the project. See section 3 for details.
- Rather than organising dedicated job fair and industry days for MoSaiQC, MoSaiQC ESRs attended a combination of existing events (CLEO Europe and Laser World of Photonics) and a MoSaiQC-specific company visit at MoSaiQC partner TOPTICA in Munich in June 2023. See section 5 for details.
- In the DoA we planned for ESRs to significantly improve Wikipedia pages that are related to the core topics of MoSaiQC in the different languages of the project partners. During the project, we did not prioritise this task and therefore, it was not done.

11 Conclusions

Taken together, this report presents the outreach activities that were performed as part of the MoSaiQC project. Although the Covid-19 pandemic forced us to modify our planned outreach activities, we have been able to deliver most outreach activities as planned in the DoA.

MoSaiQC outreach was part of WP4 - Dissemination and Outreach and is specifically linked to objectives 1, 2, 3 and 6 of WP4. Below, we indicate for each objective, which outreach activities were undertaken to meet this objective.

Objective 1: *Equip ESRs with the tools to engage with society (influencers, educators, the media, and the general public) through a variety of mechanisms, including practical skills for presenting to different audiences, designing successful outreach projects and programmes, and media skills.*
Actions and activities related to this objective:

- All ESRs took part in the transferable skills training “Pitching your Research” offered by Hertz training for scientists. As part of this course, ESRs were taught how to present their research to the general public. See section 6.
- ESRs visited Munich in the week of June 26-30, 2023 for 3 events in that week; (1) The Conference on Lasers and Electro-Optics (CLEO Europe) that took place in Munich from June 26-30, 2023; (2) The Trade Fair Laser World of Photonics that took place in Munich from June 27-30, 2023; (3)A company visit to TOPTICA (Munich) on June 27, 2023. See section 5.

Objective 2: *Develop open and accessible online resources, promoting engagement of society with MoSaiQC and its scientific goals and activities.*

To meet this objective, we have used the MoSaiQC project website (https://www.mosaiqc.eu/) and social media. See section 3.

Objective 3: *Develop and deliver outreach activities (e.g. lay articles in non-specialised public addresses, activities at science fairs, public talks etc.), open labs for various occasions.*
Actions and activities related to this objective:

- To meet this objective, ESRs and supervisors were involved in educational outreach. They were involved in teaching undergraduate students at the different partner universities (UvA, UoB, TUW, IUBK, UMK). See section 4.
- ESRs took part in local outreach activities. See section 6.
- Publication of a popular scientific article. See section 6.
- Popular scientific talks. See section 6.
- Popular scientific videos. See section 6.
- Lab visit at UvA by French president Macron, King Willem-Alexander of The Netherlands, a CEO of Samsung and many others. See section 6.
- Lab tours at UCPH for national and international visitors, as well as ambassadors and foreign ministers from a range of countries at UCPH. See section 6.
- Participation of ESRs and supervisors in open lab/institute days, school days and Girls Days. See section 7.
- Collaboration with a graphical artist. See section 8.

Objective 6: *Deliver the selected MoSaiQC MOOC.*

The MoSaiQC MOOC (https://www.mosaiqc.eu/mooc.html) was delivered as Deliverable D4.4. See section 4.

Outreach activities related to the results of the MoSaiQC project will continue after the project ends. In part, this will be as part of follow-up projects or future projects, and, in part, this will become part of the ongoing outreach activities at the different partners. Moreover, the MoSaiQC project has trained 16 ESRs in the field of optical clock technologies and in communication strategies. Many of the ESRs are expected to continue to work in this research field and thereby naturally disseminate the MoSaiQC results to the wider community.