People behind PASQuanS

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Rosaria Lena

University Strathclyde, UK
Research Associate (Post-doc), Theorist

Could you briefly describe your institutional and personal role within the PASQuanS project: Which specific project activities are you involved in?

I work in the theory team at the University of Strathclyde and my role is to investigate new ways to control quantum simulators that are used in the experimental groups within PASQuanS. Quantum systems are unavoidably coupled to their surroundings and can dissipate energy into them or establish correlations with the environment. This interaction with the surroundings includes the coupling with the experimental apparatus that allows us to make measurements on the system, which ultimately disturb it. In my project I describe how quantum systems behave when we start making measurements and when we put information, recovered from the measurement, back into the system. This allows us to study new ways to control the system's behaviour by engineering measurement and feedback systems. Investigating this is useful in the context of quantum simulations and we hope that it will open up new opportunities to use such platforms to solve new problems relevant to applications within the PASQuanS project.

Which results have already been achieved on your end and what will be the next milestones?

We made good progress in terms of engineering schemes of measurement and feedback on quantum systems to obtain states with reduced uncertainties. This can be useful to increase the efficiency of quantum simulators, as well as to achieve more precise measurements in the context of quantum metrology and quantum sensing. This way we can overcome the limitations imposed by any classical protocols in different technological applications, ranging from higher precision atomic clocks to imaging to gravitational waves detection.
The next milestone would be to identify key elements to integrate these protocols into the experimental apparatus used by other groups in PASQuanS.

For you personally, what has been most fascinating about the project so far and how do you think PASQuanS will impact your future career?

The most fascinating thing about the project is that I gained more insights about how what I do is not strictly theoretical, but eventually leads to solving experimental problems by introducing or rethinking some methodologies. Despite the fact that I am not sure about the direction I will take in my future career, I am really excited about all the opportunities that are opening up in industry. Also, the fact that PASQuanS offers a bridge between academic and industrial partners opens new prospects across a broad range of fields for the future.

The Quantum Flagship Initiative will help to bring quantum technologies from the lab to the market. Which role do the PASQuanS platforms play here and where do we stand?

Following up from the previous questions, I find it really exciting that PASQuanS is bringing together both theoretical and experimental groups in academia with industry, as well as setting the ground for delivering products in the market for end-users.

What we are witnessing is that we are at the stage where the boundaries between different fields are getting less sharp. As an example, I work with ultracold atoms and combine elements of quantum simulations and quantum sensing. The applications of quantum sensors are so broad that they range from imaging, which is of interest not only to physicists but also to biologists and chemists, to the detection of gravitational waves, which involves astrophysicists and engineers.

Bringing people together in projects like PASQuanS is therefore one of the necessary steps towards the long-term goal of having more quantum technology in the market, and ready for end-users.

How did you get to join the PASQuanS consortium and how do young researchers in particular benefit from the involvement in EU research projects?

I joined the PASQuanS consortium thanks to Prof. Andrew Daley who offered me some exciting projects to work on. Being involved in EU research projects is beneficial for young researchers because people from different countries and universities usually have different backgrounds, and this diversity is key to bringing new elements and ideas to projects.

More broadly speaking, participating in EU research projects is beneficial for all researchers, for the reasons I mentioned in the answer to the previous question: different countries have different strengths in various fields, and as quantum technologies grow, people from a broad range of expertise have to work together to bring their knowledge and strengths to other areas. The more people from different countries are part of a network with a common goal, the greater the chance that we will create something that is world leading.

One thing we'd like to do within PASQuanS objectives is to bring the general public closer to understanding quantum simulators and quantum technologies. How relevant do you think this is at this stage, and what can we do in terms of science communication?

I have personally been involved in several outreach activities where I try to bring people of any age closer to understanding quantum physics. What I see is that there is still a gap in the general knowledge, as some people seem to be intimidated by quantum physics, thinking that it is something out of their reach and relevant only to physicists. As the target of our research in quantum simulators moves to the market and end-users, however, a broader knowledge in quantum physics from the general public would be required. I think it is becoming even more important now to advocate for more outreach activities and to introduce young people to concepts of quantum physics already in schools.