

Conference Report

spinQueST Conference, August 17th to 21st 2025, Congressi Stefano Franscini (CSF) Conference Center, Monte Verità, Ascona

Shi-Xia Liu, Silvio Decurtins, Harald Brune, Pietro Gambardella, Christian Wäckerlin, and Thomas Jung*

*Correspondence: T. Jung, E-mail: thomas.jung@psi.ch
Paul Scherrer Institute

Spin-based Quantum Science is a cross-disciplinary endeavour and of core importance towards controlling electron and spin-based quantum systems in an addressable and scalable way. On these grounds it has been a great honour to hold the spinQueST conference in August 2025, in the Year of Quantum Science and Technology (IQ) declared by many learned societies and UNESCO (<https://quantum2025.org/>) in order to celebrate the anniversary of Quantum Mechanics as well as to foster the presently booming opportunities in its exploitation in a broad field of scientific and technological contexts.

Quantum science in general, and spin-based quantum science in particular, is a showcase of how curiosity driven science, too often perceived to be isolated in the ivory tower of academia, is putting itself to use. Over the past decades, several devices based on quantum effects have become widespread commodities and have assumed core roles for societies and economies, while the root of their invention has been lost in translation. Today's quantum science, and even more so the (r)evolution of future quantum technologies depends on the close interaction of physics, chemistry, materials science, and engineering as we need to explore and exploit the quantum properties of materials before integrating them into devices and before establishing technologies. Materials must be made, synthesized, purified, and/or grown before their core quantum properties can be

investigated. Towards building operable quantum systems, *e.g.* in the form of hierarchically integrated devices, many cycles of trial and error are needed. Conferences here play a key role to foster cross-disciplinary and cross-border discussions to promote creativity, discuss and improve scientific understanding, shift boundaries of knowledge, and to cast innovative ideas into prototypes beyond presently established technologies.

Coincidentally, soon after the discussion of some of the new quantum materials and their 'hot' quantum properties based on metal-organic-coordination-networks (MON's) or 2D metal organic frameworks (2D-MOF's) at the spinQueST conference, the Nobel Prize in Chemistry was granted to the inventors of the 3D analogue, *i.e.* to metal-organic frameworks. In both dimensionality cases, it is the overwhelming tunability of metal organic frameworks by their – at least two – components which provides the key to scientific breakthroughs, new properties, and technological applications. Investigations of electron and spin states across surface-supported atomic and molecular systems allow for a large body of novel insights into structure-property correlations down to the quantum, atom, bond, and electron/spin state level. All this has been possible due to unique, new, and emerging local probe techniques combined with averaging spectroscopies gaining spin and electron state resolution.

These reasons motivated us to hold the spinQueST conference on Monte Verità in Ascona where inspiration is borne from the long-term history of the site. We brought synthetic and computational chemists together with experimental physicists and experts in quantum properties of materials. More than 25 leading experts from all over the world presented lectures for the ~100 attendees in total (Fig. 1).



Fig. 1. Conference photo taken at the CSF on Monte Verità. Photo credit Conference committee.

A dense program was assembled in focused sessions *e.g.* ‘Real and artificial atoms’, ‘Molecular magnets’, ‘Quantum dots’, ‘Experimental probes’, ‘Theoretical methods’, and ‘Quantum simulators’. Important discussions included the degree of validity of different numerical approaches to obtain the best possible agreement between experiment and theory, the different evidence for the presence of Majorana fermions near on-surface spin chains of different covalent or non-covalent architecture, and the different methodological approaches for local quantum and spin sensing within on-surface architectures. The program, the venue, and the atmosphere fostered lively discussions among all participants.

The participants also gathered at two lively poster sessions to discuss intensively on a person-to-person basis. The session provided the framework for the nomination of the CSF young scientist award by a committee led by Prof. S. Decurtins. The awardee, Stefan Schulte, is a young scientist from the Peter Gruenberg Institute at Forschungszentrum Jülich (Fig. 2) who reported about his recent achievement in ‘A quantum dot-functionalized scanning tunnelling microscope tip in the resonant tunnelling regime: Sensing through the electron-phonon coupling’.

research centres as well as in some cases, successfully recruit staff.

We are all grateful for the fantastic support and services provided by Congressi Stefano Franscini and the staff at Fondazione and Hotel Monte Verita who contributed essentially to the success of the conference grace to their flexibility and frictionless cooperation at close to maximum occupancy. It is important to say that the conference was also supported by the home institutions of the organizers. Last but not least, the conference would not have been possible without the funding provided by our Sponsors, *i.e.* the Swiss Quantum Initiative and the Division of Fundamental Research of the Swiss Chemical Society (SCS). Also, the exhibitors listed on the conference website www.spinquest.ch contributed valuably to the funding and allowed us to keep the conference charges for participating students to an affordable level. Finally, we are very grateful for the contributions of the ETH Domain to Congressi Stefano Franscini (CSF) and the Swiss National Science Foundation (SNSF) who are contributing to the operation of this beautiful place for hosting scientific conferences in Switzerland.

Received: April 28, 2026



Fig. 2. The awardee of the CSF young scientist award: Stefan Schulte, a young scientist from the Forschungszentrum Jülich in Germany, here reviewing his work after receiving the award from one of the conference chairs. Photo credit Conference committee.

A vendor exhibition was organized and some of the vendors advertised the most recent breakthroughs in experimentation and microscopy in pitch talks and by demonstrations at their booths. The open discussion atmosphere between instrument manufacturers and representatives of the leading academic research groups are important for the scientific community, as well as for the instrument manufacturers. The better and faster tools promote scientific progress and allow realistic performance assessments before procurement to save resources. Manufacturers, on the other hand, can improve and adapt their products to the most recent state of the art developed within