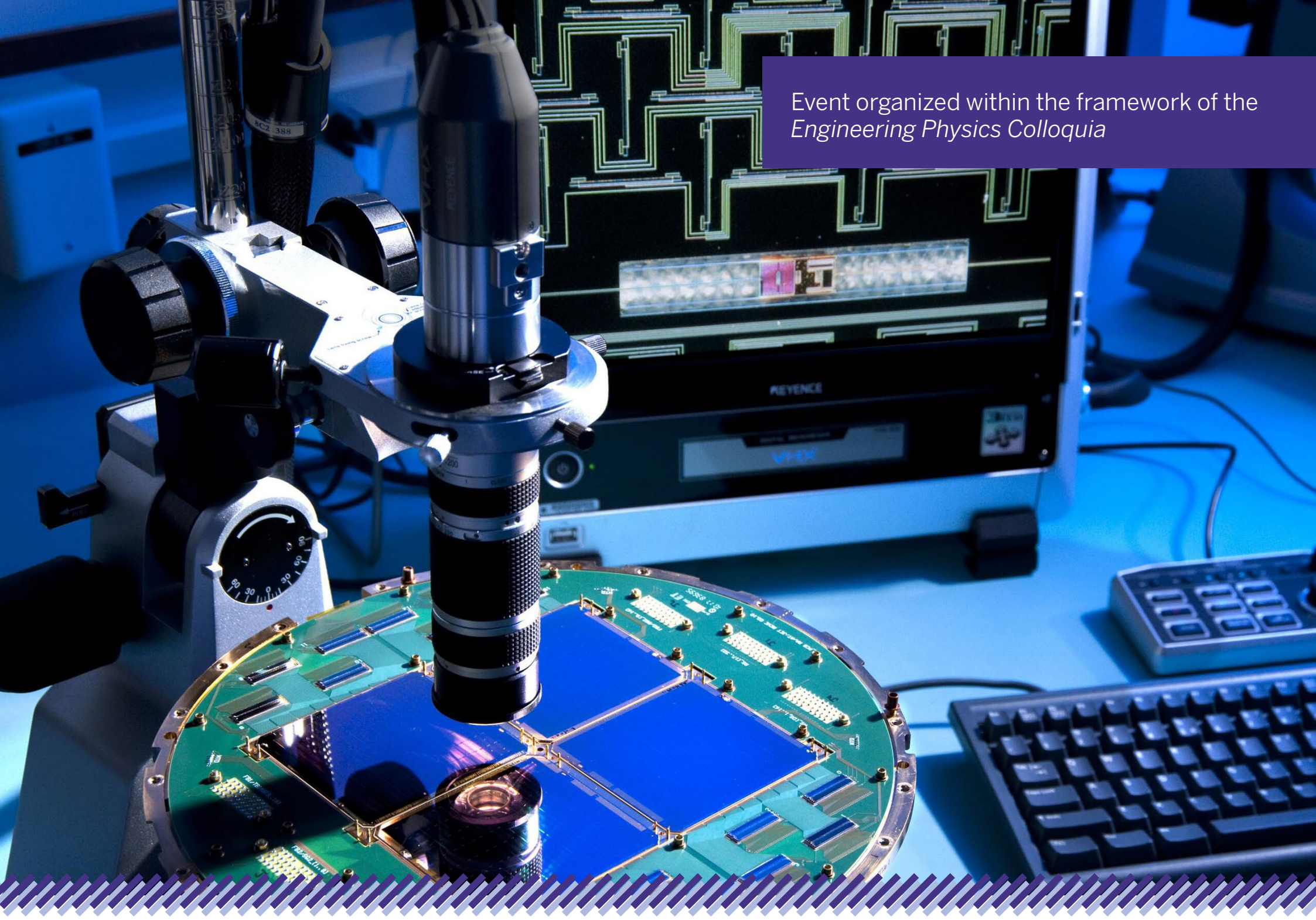

Event organized within the framework of the *Engineering Physics Colloquia*

Prof. **Thilo Bauch**
Chalmers University of Technology (Sweden)

Ca' Foscari University of Venice
Department of Molecular Sciences and Nanosystems

Nanoscale YBCO Devices for Quantum Sensors and Detectors

20th February 2026, 11.00

Conference Room Orio Zanetto, Alfa Building

The seminar will also be accessible remotely via the following link: **https://unive.zoom.us/j/84738358126**
Password: seminar1

Organized by
Domenico De Fazio
Riccardo Arpaia

Recent advances in nano-patterning of high critical-temperature (high-Tc) superconductors have enabled simpler, more versatile, and highly sensitive quantum devices, such as SQUID magnetometers, THz mixers, and single photon detectors. Conventional approaches using bicrystal and step-edge Josephson junctions, developed in the 1980s and 1990s, rely on complex epitaxy and multilayer structures that limit performance and design flexibility. Our nanoscale Dayem bridges and novel grooved Dayem-bridge process address these limitations, offering an effective alternative. We present SQUID magnetometers based on GDBs that match or exceed the low-noise performance of conventional SQUIDs at moderate temperatures (~77 K). This enables applications like magnetoencephalography (MEG) with sensor placement within 1 mm of the scalp, capturing stronger neuromagnetic signals and improving imaging resolution. Additionally, we demonstrate THz harmonic frequency mixing using a YBCO nanobridge with cross section 70 × 50 nm² integrated with a spiral broadband antenna. At 1.2 THz (x12 mixing), with ~1 μW input and operating at 77 K and 60 K, the device achieved a 20 dB SNR at 1 Hz bandwidth. These results highlight the suitability of nanowire-based devices for high-frequency detection. Finally, we report dark count observation in ultra-thin (10 nm) YBCO nanowire single photon detectors below 20K. The high critical current density leads to hysteretic current voltage characteristics (IVCs), enabling bistable switching and revealing fluctuation-induced dark pulses. This marks a milestone toward developing YBCO-based quantum detectors for high-temperature operation.