QUBE-II - Quantum Key Distribution with a CubeSat

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Quantum Key Distribution (QKD) is a method to securely share cryptographic keys between two parties via a quantum channel and an authenticated classical channel. To enable global QKD on a scalable platform, CubeSats provide an attractive approach for fast and cost-efficient research projects.

Based on the QUBE-I mission, which served as a technology pathfinder, the QUBE-II mission [1,2] is a joint research project by the Friedrich Alexander University Erlangen-Nuremberg (FAU), the Max Planck Institute for the Science of Light (MPL), the German Aerospace Center Institute of Communications and Navigation (DLR-IKN), Zentrum für Telematik (ZfT), OHB System AG, and the Ludwig Maximilian University Munich (LMU), and aims to demonstrate QKD from satellite to ground. Using a CubeSat with a volume of about 8 liters, the satellite features amongst others a quantum random number generator (QRNG), three QKD sender payloads, a full-stack postprocessing board, as well as an laser communication terminal. The stack comprising all quantum payloads shown in Fig. 1 poses a rigid cube of only about one liter in volume. The QUBE-II satellite shown in Fig. 2 has been launched on 3rd of May 2026 with a SpaceX Falcon 9 rocket from Vandenberg Space Force Base.

In my talk, I want to highlight the major milestones and achievements towards the launch and discuss the path for the following months. I will focus on the development of both payloads from LMU and will give *lessons learnt* during development of QUBE and QUBE-II.

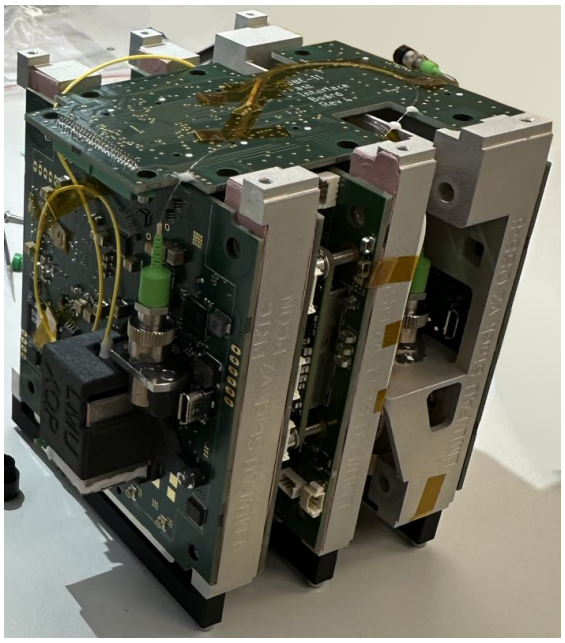

FIG. 1. The quantum payload stack of the QUBE-II mission during payload integration. A *fast interface board* at the top connects the payloads electrically.

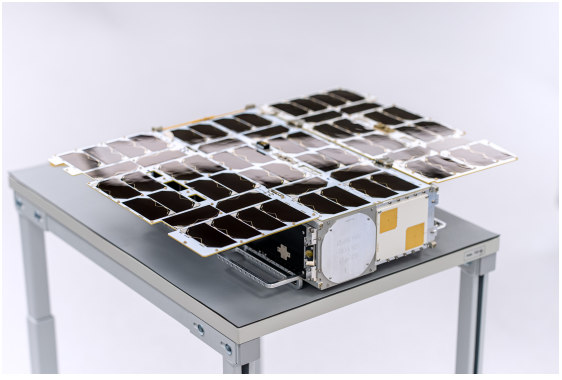

FIG. 2. The fully assembled satellite before integrating into the deployer and the rocket. On the front side, the circular shaped cover protects the 80 mm aperture of the telescope. The S-band patch antenna is placed on the right-hand side. The solar panels are unfolding after ejection from the deployer.

References

[1] M. Hutterer et al., *QUBE-II-Quantum Key Distribution with a CubeSat*, 73rd International Astronautical Congress, IAC (2022).

[2] M. Steinberger, M. Auer, A. Baliuka, M. Birkhold, H. Weinfurter, L. Knips, *Polarization-Encoded BB84 Quantum Key Distribution for the Nano-Satellite Mission QUBE-II*, 2025 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC) (2025).