M1 Internship at the Grenoble University Space Center (CSUG) :

Preliminary feasibility studies of the space segment of a future Quantum Internet

A consortium of laboratories of the Sorbonne Université (LIP6), CNRS-Université de la Côte d'Azur (UCA) and the Grenoble University Space Center (CSUG), with consultancy support from the satellite operator Eutelsat, and under the direction of Thales Alenia Space France (TASF), has been selected by the French National Space Agency CNES to carry out a feasibility study of a Satellite-enabled Quantum Information Network.

CSUG will be in charge of the preliminary definition of an in-orbit demonstrator. To support this effort, we are looking for candidates for internships during their penultimate year of study (i.e., M1). Several topics are foreseen that, depending on the length of the internship, can become part or whole of one or more internships:

- Identify and evaluate different subsystems of the space segment.
- Carry out a Size, Weight and Power (SWaP) analysis.

The study will use input elements provided by the other partners in the project, notably concerning the system dimensions, constraints and specifications of the subsystems, the road map, and the definition and specification of the in-orbit demonstration.

We are looking for someone with a critical and analytical mind, innovative, capable to distinguish main issues from side issues ('to see the wood for the trees') and to synthesize, carefully document, and present his/her work. We expect a good background in at least one of the following areas of physics: optics, classical mechanics, or thermodynamics (heat).
We offer a highly fascinating subject (see below), integration in the CSUG team with many other students, expertise in the relevant areas of physics, and interactions with researchers and engineers of the project partners. The internships can take place between February 2019 and June 2020 and will be remunerated according to UGA standard practice.

As to the interest of the study: Quantum communication concerns the transport of a type of information that is fundamentally different from its classical counterpart of telecommunications. It requires components and an infrastructure that cannot be reduced to a classical telecommunication network. A quantum network would enable, among other things, quantum computing "in the cloud", quantum sensor networks, and clock synchronization. Quantum cryptography is generally considered to be one of the first applications. In this context, the quantum information can be coded into the polarization states of photons. In order to transmit such states over long distances, there are essentially two possibilities: the use of optical fibers, or free space. Only the latter permits to extend the range to inter-metropolitan distances. Future quantum networks are therefore expected to be based upon metropolitan scale fiber networks inter-connected by quantum satellite links. It is the latter part that is the object of our study, which will be similar in nature to a previous phase-0 study carried out by the CSUG of a nanosatellite for quantum secure communications [1].

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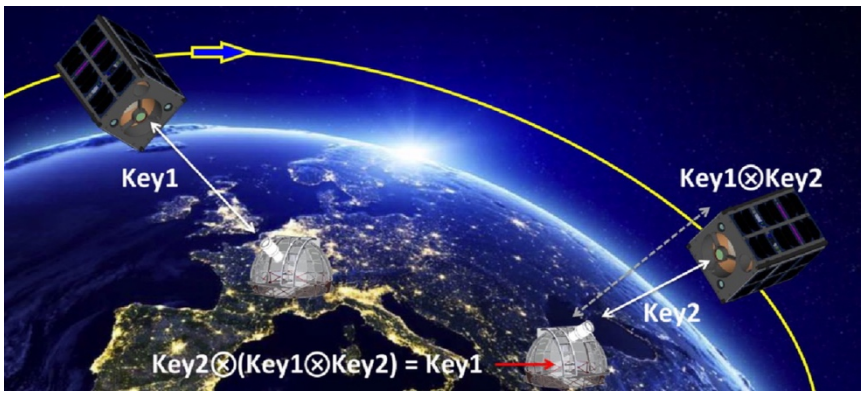
[1] https://doi.org/10.1140/epjqt/s40507-018-0070-7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