SpooQy-1, A CubeSat to Demonstrate an Entangled Photon Light Source

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Quantum Key Distribution (QKD) is a technology that can distribute private encryption keys between two parties with strong security assurances underpinned by quantum mechanics.
QKD in Space

Ground-based QKD

• Has limited range due to in-fibre attenuation and atmospheric loss
• Line-of-sight limitation

Space-based QKD

• Optical beam travels further in space (Only few tens of km of atmosphere)
• Large coverage
• Satellite is difficult to hack

We use CubeSat

Conventional Satellite (~ 600kg)  Nano Satellite (cubesats) < 10kg

The Biggest Challenge: Miniaturizing the Quantum Light Source!
Miniaturizing the Light Source
The Road Map

**Correlated Source**
- Low brightness
- Proofs of concepts
- Balloon, shared CubeSats.
- Photons all detected on board

**SpooQy-1**
- Full QKD-strength, tech demo
- Under development
- Photons all detected on board

**Future**
- Inter-satellite QKD demos
- Space-to-ground QKD demos
- Quantum satellite network
First Space Attempt —— GomX-2
The Galassia Mission
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SpooQy-1

Quantum light source

3U Satellite Frame and Ribs

Satellite Antenna

Isostatic Mount Assembly (UNSW Canberra)

Solar Panels

Satellite Sub-System
Quantum Light Source

1: laser diode  
2: prism pair  
3: fluorescence filter  
4: half-wave plate  
5: YVO4 (pre-compensator)  
6: BBO1&2  
7: dichroic mirror  
8: long-pass filter  
9: BBO3&4 (spatial-compensator)  
10: YVO4 (temporal-compensator)  
11: dichroic mirror  
12,12': prism pair  
13,13': half-wave plate  
14,14': liquid crystal (as a polariser)  
15,15': PBS  
16,16': interference filter  
17,17': avalanche photodetector  
18: photodiode
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Satellite to Satellite QKD

Image Courtesy of UNSW Canberra, Australia
Collaboration Welcomed

- Optical terminals
- Fine pointing ADCS
- Optical beam steering
- High accuracy position knowledge

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