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GrailQuest & HERMES: Hunting for Gravitational Wave Electromagnetic Counterparts and Probing Space-Time Quantum Foam

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GrailQuest (Gamma-ray Astronomy International Laboratory for Quantum Exploration of Space-Time) is an ambitious astrophysical mission concept that uses a fleet of small satellites, whose scientific objectives are discussed below.

Within Quantum Gravity theories, different models for space-time quantisation predict an energy dependent speed for photons. Although the predicted discrepancies are minuscule, Gamma-Ray Bursts, occurring at cosmological distances, could be used to detect this signature of space-time granularity with a new concept of modular observatory of huge overall collecting area consisting in a fleet of small satellites in low orbits, with sub-microsecond time resolution and wide energy band (keV-MeV). The enormous number of collected photons will allow to effectively search these energy dependent delays. Moreover, GrailQuest will allow to perform temporal triangulation of high signal-to-noise impulsive events with arc-second positional accuracies: an extraordinary sensitive X-ray/Gamma all-sky monitor crucial for hunting the elusive electromagnetic counterparts of Gravitational Waves. A pathfinder of GrailQuest is already under development through the HERMES (High Energy Rapid Modular Ensemble of Satellites) project: a fleet of six 3U cube-sats to be launched by the end of 2021-beginning 2022.

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