Short presentation of a project proposal for the 5th call Space in FP7

„Laser ranging systems for better observations in and from space“

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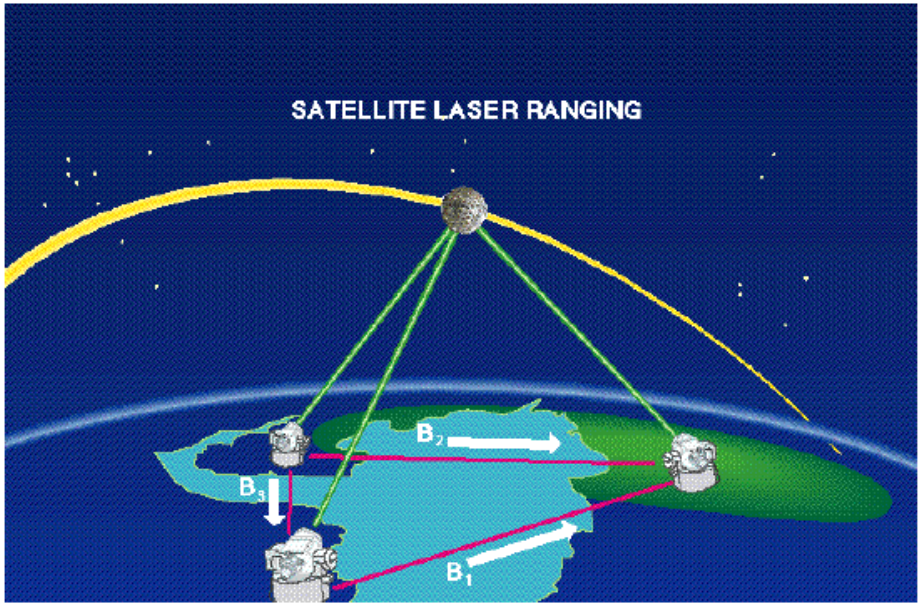
FP7 Space NCP Network

Short outline / Proposal concept I

Satellite laser ranging

- Unambiguous time-of-flight measurement
- 1 to 2 mm normal point precision
- Passive space segment (reflector)
- Simple refraction model
- Night / Day Operation
- Near real-time global data availability
- Satellite altitudes from 400 km to 20,000 km (GPS, GLONASS) and the Moon
- Centimeter accuracy satellite orbits
  - ~ 1-2 cm (LAGEOS)
  - ~ 2-3 cm (GPS)



Astronomical Institute of University of Latvia:
Experience in **building satellite laser ranging stations**

Draft Call Topic that the Proposal Aims at*

Strengthening the foundations of Space science and technology (SSF)

- ***Research to support space science and exploration***
  - Exploitation of space science and exploration data
- ***Research to support space transportation and key technologies***
  - **Key technologies enabling observations in and from space**
  - Key technologies for in-space activities

Cross-cutting activities

- ***SME specific research***
  - Bringing terrestrial SME research into the space domain

*Please chose the topic from the list, erase the others and adapt the letter size adequately.

Short outline / Proposal concept I

Satellite Laser ranging

- Present state of the art: picosecond lasers
- We propose to use: **femtosecond lasers (optical frequency comb)**
  - Combination: **time of flight + interferometry**
  - Potential to improve distance measurement precision
  - Multi color: better characterize atmospheric thickness

nature photonics

ARTICLES

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Rapid and precise absolute distance measurements at long range

I. Coddington*, W. C. Swann, L. Nenadovic and N. R. Newbury*

The ability to determine absolute distance to an object is one of the most basic measurements of remote sensing. High-precision ranging has important applications in both large-scale manufacturing and in future tight formation-flying satellite missions, where rapid and precise measurements of absolute distance are critical for maintaining the relative pointing and position of the individual satellites. Using two coherent broadband fibre-laser frequency comb sources, we demonstrate a coherent laser ranging system that combines the advantages of time-of-flight and interferometric approaches to provide absolute distance measurements, simultaneously from multiple reflectors, and at low power. The pulse time-of-flight yields a precision of 3 μm with an ambiguity range of 1.5 m in 200 μs. Through the optical carrier phase, the precision is improved to better than 5 nm at 60 ms, and through the radio-frequency phase the ambiguity range is extended to 30 km, potentially providing 2 parts in 10^{13} ranging at long distances.

Orientation Consortium I

- University of Daugavpils, (coordinator?)
- **Institute of Physical Research and Biomechanics, Latvia, SME, project management**
- Astronomical Institute of University of Latvia, Experience of modelling and **building satellite observation optics**
- Max Planck Institute of Quantum Optics, Germany, Munich, **scientific idea**
- Menlo Systems GmbH, Germany, **industry, fs lasers**

Consortium II

- Wanted partners / competencies

- **Additional Partners to build a consorcium**

- **Option B: Exsisting consortium who can take our idea as a part of their project.**

Contact and further information (if any)

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Scientific aspects:

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