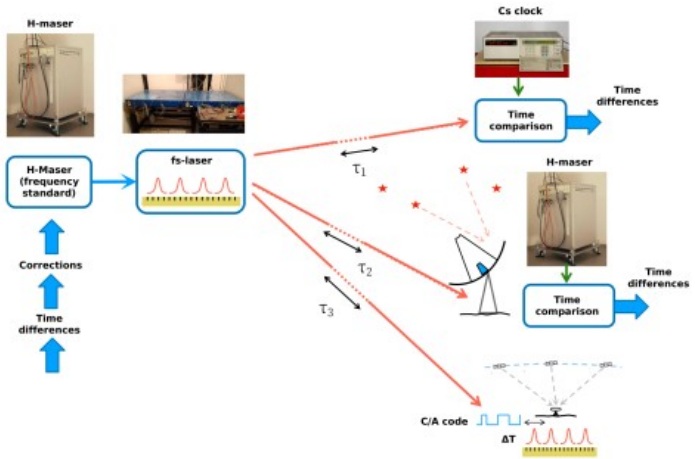
Bachelor/Master project at Geodetic Observatory Wettzell

VLBI calibration using microwave comb derived from mode-locked laser

Project description/Projektbeschreibung:
Very Long Baseline Interferometry (VLBI) is used to measure the Earth's rotation and orientation with respect to Celestial Reference Frame. These parameters are essential for navigation and geodesy. They are estimated from many measurements of the time difference between the arrivals of radio signals propagating from distant radio sources, i.e. quasars to different geodetic radio telescopes. To achieve the greatest possible accuracy the quasars must be spread across the entire sky.
When the antenna moves from one quasar to another, its instrumental delay changes and spoils the measured quantity. Therefore, radio telescope instrumental delay must be accurately calibrated. For that reason, a microwave comb is injected into a receiving chain and recorded together with a quasar signal. In post-processing, the delay of the microwave comb is estimated and subsequently removed from the measurement.

Aims of the project/Projektziele:
In this project, we plan to generate a calibration microwave comb from a recently established optical timing system that distributes time and frequency around the Geodetic Observatory Wettzell using a femtosecond mode-locked laser. The operational repetition rate of the timing system is 100 MHz, but for the calibration microwave comb 1 or 5 MHz are needed. Therefore, the frequency of the time distribution system has to be divided. Additionally, the optical link, which brings the optical pulses to the calibration point, moves with the antenna position and changes the polarization at the link output. Thus an optical pulse picker, which uses an Electro-optic modulator cannot be used. Instead, a polarization-independent high-speed optical shutter which is based on multiple quantum well (MQW) structures (SOA1013SXS) should be used.
The goal is to design and test a prototype of an optical pulse picker, which can divide the fundamental repetition rate of the optical timing system, and which will be independent of light polarization.



Skills/Kenntnisse:
This project requires knowledge in physics or electrical engineering

Questions are appreciated! Please ask:

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Hinweis:
Dieser Projektvorschlag wird in Englisch veröffentlicht, um deutsche und internaltionale Studierende anzusprechen. Die Arbeit kann, wenn die Bedingungen der Prüfungsordnung es zu lassen, in Deutsch oder Englisch verfasst werden. Auch am Observatorium wird hauptsächlich deutsch gesprochen.