Technische Universität München

der Bundeswehr Universität München

Wissenschaftliche Mitarbeiterin bzw. Wissenschaftlicher Mitarbeiter (m/w/d) an der Fakultät für LRT am Institut für Raumfahrttechnik und Weltraumnutzung auf dem Gebiet der Satellitennavigation

(Salary according to TVöD-E13)

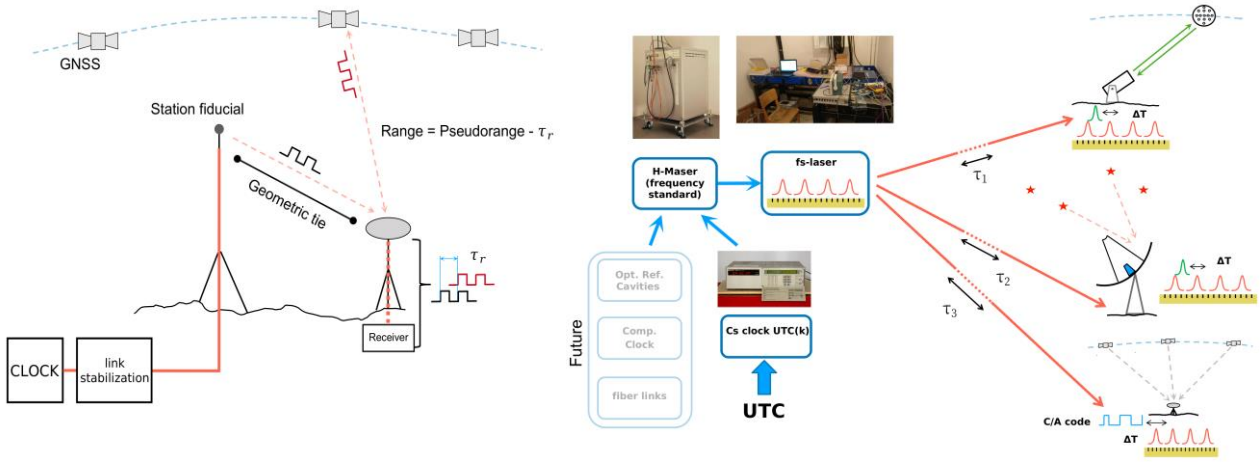
We search for a colleague at the earliest possible date, limited to 4 years with the option of extension.

Global satellite navigation systems are a cornerstone for Earth science covering global changes research, global deformation, and mass transport. However, the legitimate question arises if the accuracy and stability are sufficient for monitoring local and global changes like sea level rise with the desired resolution. Amongst others, the navigation quality is highly dependent on a stable and accurate reference frame.

Reference frames are based on high-precision data from the space geodetic techniques, as provided by geodetic observatories like the Geodetic Observatory Wettzell. A higher accuracy of the underlying data is needed to improve the reference frames. A promising approach is examining imperceptible error sources which influence all measurement types of equipment and which are not captured by any calibration. To make them visible, different kinds of combinations of techniques are needed.

Under DFG funding, a new research unit was recently established, consisting of 10 research groups distributed among many institutes in Germany, whose goal is a novel approach to **Time in Geodesy**. Within this project, our research group is a cooperation between the Forschungeinrichtung Satellitengeodäsie (Technical University of Munich) and the Institute of Space Technology and Space Applications (ISTA) at the Unversität der Bundeswehr München. Here our main contribution will be developing the technique for combination of common calibrated signals generated from the same clock source in order to tie up different time-reference frame setups.

More specifically, we will calibrate GNSS receivers in real-time using a unique optical time and frequency distribution system and artificially generated navigation signals. This way, we will combine GNSS and Very Long Baseline Interferometry through a common calibration. The task of the applicant is to develop such a GNSS calibration.



Forschungseinrichtung Satellitengeodäsie at the Institute for Astronomical and Physical Geodesy TUM participates in the operation of the **Geodetic Observatory Wettzell**. We operate a unique time and frequency distribution system based on optical frequency comb technology, for which Theodor Hänsch 2005 received a Nobel prize. This distribution system is a cornerstone for the entire research group dealing with Time in Geodesy. We further operate several GNSS receivers, radio telescopes, and GNSS signal simulators. We use a reference laser ranging station for time transfer between space and ground segment, which is part of the Atomic Clock Ensemble in Space project (under ESA). In the long term, the geodetic observatory Wettzell presents one of the highest concentrations of technology for space geodesy in the world.

The professorship for satellite navigation (LRT9.2) as part of the Institute for Space Technology and Space Applications and as part of the Research Center SPACE has been dealing with GNSS signal structure and planning since 1983. Together with partners from research and industry, the institute is significantly involved in further developing Galileo, innovative algorithms, and GNSS applications. Part of the recent activity is the terrestrial transmission of artificial satellite signals, i.e., pseudolite technology.

In order to provide highly qualified research in this field of GNSS signals generation and processing, the Universität der Bundeswehr München and Technical University München search for a Ph.D. candidate. The task is to get involved in the scientific group dealing with the Time in Geodesy. This position will be formally conducted under Universität der Bundeswehr München. The candidate can decide under which of the two participating institutions the Ph.D. studies will take place. In this job proposal, we do not limit an applicant, whether the work will be conducted in the workplace in München or at the Geodetic Observatory Wettzell. However, we expect a willingness to travel according to the requirements between those two places. The candidate should be prepared to stay part of the work internship in Wettzell and München.

Your tasks:

- Development of terrestrial artificial navigation satellite signals
- Accurate synchronization of the signals to an optical timing signal
- Interference analyses, multipath suppression
- Optimization of transmitting and receiving terrestrial navigation signals
- Transfer of laboratory construction into the productive calibration process of the observatory
- Organizing experiments
- Identification of issues, participation in project acquisition, publication of research results in journals, international conferences, and intern status seminars

Qualification requirements:

- Master's degree in electrical engineering, geodesy, physics, mathematics, or in aerospace engineering
- Programming knowledge (MATLAB/Python and/or C++), interest in building complex systems and prototypes
- Knowledge of field programable logic (FPGA) and software-defined radio is an advantage
- Experience with PCBs and soldering is an advantage

What do we expect:

- Team cooperation, presentation, and communication skills
- Previous knowledge in the field of signal processing or navigation/positioning is an advantage
- Willingness to learn new things, work independently, and finish this work internship with Ph.D. degree

We offer:

- Accommodation with a complex, technologically highly relevant subject area, which enables diverse, lucrative, and long-term career opportunities in the industry, research, or at space agencies
- Work with high-end instrumentations like optical timing systems, software-defined radios, and panning and organizing experiments with VLBI
- Candidate can decide if the Ph.D. will be conducted at TUM or UniBw
- Promotion of your scientific development and the opportunity to do a Ph.D.
- Working in an international team of highly motivated colleagues
- Flexible working hours and the possibility of working partially from home
- Flexibility where the main work will be conducted (München or Wettzell)
- We offer a 4-year full position classification in pay group E13 TV-L (75%); with regard to the activities to be carried out and the fulfillment of personal or collectively agreed requirements, the E13 TV-L 25% will be paid as a benefit taking into account the performance of the employee
- Possibility to extend for the next four years as PostDoc, according to project flow

The Technical University München and Universität der Bundeswehr München strive to increase the proportion of female scientists, and applications from women are expressly welcomed. Handicapped persons will be given special consideration if they are equally qualified. Both TUM and UniBW offer institutional family support; details can be found under (https://www.chancengleichheit.tum.de/diversity/familie/) and (https://www.unibw.de/familienservice).

Are you interested?

Then send your application documents (cover letter, curriculum vitae, diplomas, possibly job references) in PDF format (max. 10 MB) by e-mail by **March 19**, 2023, with the subject: "**Application: TimeSync Ph.D. position**" to clovis.maia@unibw.de.

With your application, you agree that your personal data will be stored and processed for application purposes and forwarded to the departments involved in the application process. You can find more information on data protection under the following link: https://www.unibw.de/home/footer/datenschutzerklaerung