



The DFG-funded **Collaborative Research Center SFB 1294 “Data Assimilation – The Seamless Integration of Data and Models”**, hosted at the University of Potsdam jointly with its partner Institutions HU Berlin, TU Berlin, WIAS Berlin and GFZ Potsdam, invites applications for a **doctoral researcher position**.

Our vision. The assimilation of time-dependent data sets into complex evolution models leads to unique mathematical and computational challenges. These challenges provide the central theme of the SFB 1294. Data assimilation constitutes a rapidly expanding field at the confluence of several established research areas in mathematics, statistics and machine learning as well as applications from the natural sciences and other disciplines. Our vision is to establish a rigorous mathematical underpinning of data assimilation, to develop principled computational methodologies, and to apply these methodologies to newly emerging application fields in the geosciences, neuro-sciences, pharmacology and biophysics.

The SFB 1294 provides an excellent research infrastructure including a large interdisciplinary network of researchers and its own graduate school as well as funding opportunities for conference visits, summer schools and hosting international experts.

The position. We seek applicants for a doctoral position (TVL - E13 75%) within **Project B07: “Inferring active particle dynamics by data assimilation”**
(PIs: Carsten Beta/Robert Großmann/Manfred Opper)

The collective dynamics of so-called *active particles* – particles that are able to self-propel their motion autonomously – is a paradigm of pattern formation in active matter systems. One of the most prominent examples are bacterial systems. Their large-scale self-organization impacts many critical phenomena, including the spreading of infectious diseases or the formation of biofilms.

Using the soil bacterium *Pseudomonas putida* as a model organism, we will bring data assimilation techniques to the field of active matter in this project. Our goal is the development of a modelling framework for the complex, stochastic motility patterns of bacterial swimmers given observations of their trajectories. A particular focus is the assessment of cell-to-cell variability in the motility parameters within a bacterial population. We are specifically planning to combine experimental particle tracking and stochastic modeling to also unveil the motility pattern of this bacterial swimmer as a function of the environmental conditions (quorum sensing). For more information on our previous research on *P. putida*, we refer to Refs. [1-4].

We are looking for a highly motivated, outstanding PhD candidate interested in working on active matter with applications to bacterial motility. We are particularly seeking applicants from statistical physics, preferentially with a focus on the modeling of biological processes or, more generally, nonequilibrium transport processes. Applicants should have a strong

theoretical background but also interest in designing and performing experiments on bacterial tracking on their own. The analysis of the experiments will pose challenges in the context of automated image processing. Experience in optical microscopy and handling of bacterial cultures is advantageous but not required. The ability to communicate and closely collaborate with mathematicians is essential to benefit from and successfully integrate into the interdisciplinary environment of this CRC.

The candidate will work at the Institute of Physics and Astronomy at the University of Potsdam in the biological physics group of Prof. Carsten Beta.

The salary is determined by the collective bargaining agreement for public employees in Germany (TV-L 13). All positions are temporary in accordance with Section 2 subsection 1 of the Academic Fixed-Term Contract Law (WissZeitVG). Under the laws of the federal state of Brandenburg, employees under this contract are permitted to dedicate at least 33% of their contract time for their scientific qualification. The SFB 1294 seeks to promote diversity in research, and encourages qualified applicants of any gender and from any background to apply.

Applications to the SFB should be submitted via <https://www.geo-x.net/sfb-1294/> and should include (1) a statement of research interests and motivation, (2) a full CV, (3) the names, e-mail addresses and/or reference letters of at least two referees, (4) academic transcripts and (5) link to electronic copy of your Master/Diploma thesis (6) list of publications/talks/presentations in a single PDF file. Applications will be considered until the position has been filled. Please indicate clearly which of the projects/positions you are applying for (e.g. "B07") and state your motivation accordingly.

See the website www.sfb1294.de for further information or contact rgrossmann@uni-potsdam.de or beta@uni-potsdam.de.

References and further reading

- [1] M. Theves *et al.* "A bacterial swimmer with two alternating speeds of propagation" *Biophys. J.* **105** 1915
- [2] M. Hintsche *et al.* "A polar bundle of flagella can drive bacterial swimming by pushing, pulling and coiling around the cell body" *Sci. Rep.* **7** 16771
- [3] Z. Alirezaeizanjani *et al.* "Chemotaxis strategies of bacteria with multiple run modes" *Sci. Adv.* **6** eaaz6153
- [4] L.G. Nava *et al.* "A novel approach to chemotaxis: Active particles guided by internal clocks" *Europhys. Lett.* **130** 68002