

**Application Form for MICROKELVIN Transnational Access Project**

**1. General Information**

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| **Project number:** | **LANC 08** | | | |
| **Project Title:** | Development of Cable and Filter Protocols for Nano-electronic Device Measurements at Microkelvin Temperatures | | | |
| **Lead scientist:**[[1]](#footnote-1) | **Title:** | Dipl. Phys. | | |
|  | **First name:** | Daniel | | |
|  | **Last name:** | Harbusch | | |
|  | **Birth date:** | 30.03.2011 | | |
|  | **Passport number:** | 802441828 | | |
|  | **Research status/Position:** | PhD-Student | | |
|  | **New User:**[[2]](#footnote-2) | Yes | | |
|  | **Scientific Field:** | Quantum Transport | | |
|  | **Home institution:** | LMU-Munich | | |
|  | **Is your home institution MICROKELVIN partner?** | No | | |
|  | **Business address:** | LMU-Munich, LS Kotthaus | | |
|  | Street: | Geschwister-Scholl-Platz 1 | | |
|  | PO Box: |  | | |
|  | City: | Munich | | |
|  | Zip/Postal Code: | 80539 | | |
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|  | E-mail: | Daniel.harbusch@physik.uni-muenchen.de | | |
|  | **Curriculum vitae (18 lines max):**  2001-2007 Study of physics at the LMU Munich  Focus on: Quantum effects in nanostructures, material science and physics of semiconductors.  Title of Diploma Thesis: Quantum mechanical switching with ballistic electrons.  Topic of Diploma Thesis: Electronic transport  experiment  with coupled 1-dimensional channels al low temperatures (20 mK).  Degree: Diplom Physiker  2007-2011 PhD at LMU Munich  PhD thesis: High-frequency excitation of single electrons in coupled quantum dots  PhD work includes:  - Fabrication and characterization of laterally defined coupled quantum dots on GaAs/AlGaAs in the few electron regime.  - Development and assembly of a low temperature (20 mK) high-frequency setup, including proper filters.  - Performing pulsed-gate spectroscopy for the investigation of single electron dynamics.  - Investigation of detector back-action in mesoscopic systems. | | | |
|  | **Five most recent publications:** | | | |
|  | 1. D. Harbusch et al. Physical Review B **82**, 195310 (2010) | | | |
|  | 2. D. Harbusch et al. Physical Review Letters **104,** 196801 (2010) | | | |
|  | 3. J. Sailer et al. Phys. Status Solidi RRL 3, No 261 (2009) | | | |
|  | 4. D.Taubert et. al. Physical Review Letters **100**, 176805 (2008) | | | |
|  | 5. | | | |
| **Other participating scientists:**[[3]](#footnote-3) | **Name:** | | **Position:** | **New User:2** |
|  | 1. Dr Stefan Ludwig | | Group Leader | Yes |
|  | 2- | |  |  |
|  | 3- | |  |  |

**2. Project Information**

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| **Name of host infrastructure:** | Ultra Low Temperature laboratory, University of Lancaster, Lancaster, United Kingdom | | | |
| **Access provider / Infrastructure Director:** | **Name:**  Prof. S.N. Fisher  Prof. G.R. Pickett | | **E-mail address:** [s.fisher@lancaster.ac.uk](mailto:s.fisher@lancaster.ac.uk)  g.pickett@lancaster.ac.uk | |
|  |  | |  | |
| **Planned project dates:** | **Start date:** | **5/4/11** | **Completion date:** | **7/4/11** |
| **Project description (12 lines max):**  The Kotthaus/Ludwig group at the University of Munich has expertise in producing nano-scale devices and performing low temperature measurements on them. Access to the advanced MICROKELVIN machine at Lancaster University will allow us to cool electronic nano-circuits below the current 10 mK limit and open up new physics and behaviour. This is a major goal for the Munich group, now made much more readily achievable by the existence of the Lancaster access facility since it already has world-leading low temperature facilities, built in-house, capable of cooling samples and devices to microKelvin temperatures. Further, the new MICROKELVIN machine allows for the provision of dedicated custom wiring for sensitive measurements made by outside users. The Munich group would like an initial visit to help set up the Lancaster facility to allow for our future experiments on devices at very low temperatures. We are also bringing practical knowledge and experience to the project by advising on the upgrade of cabling and filtering that will enable these measurements to be carried out. This is the start of a new collaboration that will be of great benefit for the University of Munich and will enhance the access capabilities at Lancaster. | | | | |
| **Scientific objectives of the project (12 lines max):**  The primary scientific and technologic objective of this access collaboration is to investigate nano-electronic circuits in a hitherto unrivalled range of ultralow temperatures. This will allow the Kotthaus/Ludwig group to reach lower energy scales and investigate collective phenomena such as the Kondo effect in coupled quantum dots, the 0.7 anomaly in quantum point contacts or the hyperfine interaction between confined electrons and many nuclear spins in much greater detail compared to the current state-of-the-art. Future possibilities include the study of coherent dynamics in semiconductor-based qubits at ultralow temperatures. The combination of the expertise in ultralow temperature physics in Lancaster and in our low temperature nano-electronic measurements in Munich provides the framework for a successful collaboration. Nanostructures will be produced and initially characterized in Munich while the final ultralow temperature measurements will then be performed in Lancaster. The short term objective of this initial visit is to ensure that the Lancaster facility has the necessary cables and noise filtering systems in place to facilitate the planned future experiments. | | | | |
| **Technical description of work to be performed (20 lines max):**  In the first stages of our collaboration we will need to upgrade the cables and filters in the newly built dilu­tion unit at the Lancaster facility. The transfer of knowledge and technology between Lancaster and Munich has already started during a recent exploratory visit made by Stefan Ludwig to the UK. This transfer will now be continued by the visit of a senior PhD-student from Munich, Daniel Harbusch. He is the right person for this task; his PhD work, now almost completed, was concerned with developing the successful cable and filtering system for the present rf-measurements in nanoelectronic circuits in Munich. In detail Daniel will now lay the groundwork in Lancaster for designing and installing customized filters and cabling for our new measurements. Furthermore, it is essential that nano-devices fabricated and tested in Munich can be easily transported to and installed on the Lancaster machine. The Lancaster group will liaise with Daniel and Stefan to design a common sample holder that is optimized for the MICROKELVIN ULT experiments. These initial steps are crucial for the success of our planned experiments in Lancaster on nano-electronic circuits at ultralow temperatures. | | | | |

**3. Joint Proposals / Funding**

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| **Is this project in collaboration with other (concurrent) projects at the infrastructure?  No** |
| **If yes, please specify:** |

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| **Is this proposal submitted to any funding programmes?**  **No** |
| **If yes, please specify:** |

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The completed Application Form should be submitted to MICROKELVIN Management Office ([Katariina@neuro.hut.fi](mailto:Katariina@neuro.hut.fi), fax +358-9-47022969)

1. The lead scientist indicated here is expected to participate in the campaign as a user of the infrastructure. [↑](#footnote-ref-1)
2. Indicate ’Yes’ only if the user has never visited the infrastructure before this specific project, otherwise write ’No’. [↑](#footnote-ref-2)
3. Please list all participating user group members. Expand the table, if necessary. [↑](#footnote-ref-3)