

# Julian Stirling, PhD

*Location:* Bath, United Kingdom

*Email:* julian@julianstirling.co.uk

Physicist with significant engineering experience spanning the design and calibration of novel scientific instruments through to complex theoretical modelling of Newtonian Gravity. My work spans rebuilding and improving the United States (NIST) milligram-level force standard, to designing a microscope poised to become the first *in vitro* diagnostic device to be manufactured in Tanzania. I also have experience maintaining and running a Grade I listed 200 year old waterwheel. My experience working in diverse environments and on varied challenges gives me a unique perspective to new engineering challenges.

## Employment

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September 2022 – Present      **Freelance Engineer and Open Hardware Consultant**

- Numerous projects including: leading the prototyping of a novel automated water testing system; updating the camera calibration algorithm of a proprietary microscope; community building for the newly established Open Toolchain Foundation.

January 2018 – August 2022      **Post-doctoral Research Associate, University of Bath**

*“OpenFlexure” project*

- Developed open-source laboratory-grade microscopes being trialled for malaria diagnosis in East Africa.
- Collaborated with Tanzanian producers to establish sustainable, local microscope production.
- Designed novel monolithic, additively manufactured, optomechanical stages with sub-micron resolution.
- Developed procedures to bring an academic prototype inline with medical risk management frameworks (ISO 14971 and ISO 13485).

*“GitBuilding” project*

- Developed software to automate the creation hardware documentation in a standard format that can easily be maintained for multiple variations of the same device.

March 2016 – December 2017      **Post-doctoral Researcher, Joint Quantum Institute, University of Maryland**

- Rebuilt and improved torsion balance from the BIPM for measuring Newtonian constant of Gravitation.

March 2014 – December 2017      **Guest Researcher, NIST**

- Designed and characterised novel atomic force microscope sensors.
- Developed innovative metrological instrumentation for optical power, mass, and force. Including upgrading the NIST electrostatic force balance, reducing the uncertainty of NIST’s milligram level calibrations by an order of magnitude.

## Education

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2014      **PhD in Physics, University of Nottingham**  
*Title:* Scanning Probe Microscopy from the Perspective of the Sensor  
*Supervisor:* Prof. P. Moriarty

2010      **BSc. (Hons) Physics, University of Nottingham**  
First Class (University Prize for the highest mark in School of Physics)

## Scholarships and Awards

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- 2022            **Peter Troughton Research Staff Prize:** Yearly prize at the University of Bath for outstanding performance.
- 2016            **Highlights of 2016, Metrologia:** Selected for outstanding new research in the field of metrology.
- 2012            **Silver Humies Award:** International award for genetic and evolutionary computation which produces human competitive results.

## Skills

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### Mechanical Design and Machining Skills

- Considerable experience designing and improving custom precision scientific instruments.
- Experience using a variety of CAD software to design mechanical components and in documenting the design for remote production and assembly.
- Proficient machinist experienced with both vertical mills (manual and 2-axis CNC) and manual lathes.

### Analytical Skills:

- Developed and published complex mathematical models and modelling techniques for physics (e.g. Newtonian Gravity) and engineering (e.g. deformation of Atomic Force Microscope sensors).
- Experienced in data analysis ranging from the automated analysis of microscope images, to detailed uncertainty analysis for precision metrology.

### Programming Skills:

- Competent programmer familiar with a number of different languages and programming styles. Prefers Python; comfortable programming in C, C++, BASH, Octave/Matlab and LabView; exposure to numerous other languages.
- Experience utilising DevOps tools for combined Hardware/Software projects, including creating highly customised continuous integration workflows for both automated deployment and software testing.
- Developed software to ease documenting hardware development (see <https://gitbuilding.io>).

### Organisational Skills:

- Created quality management structure, and efficient digital workflows to transition academic hardware project into a design suitable for medical manufacturing.
- Organised international workshop in 2020 “Open Hardware from Academia” which brought together academics, industry, and legal experts.

### Leadership Skills:

- Chair of Trustees for Claverton Pumping Station Trust CIO. Managing the maintenance of a Grade I listed building and historic waterwheel-powered pump. Turned a small unincorporated community group into a registered charity within first two years of leadership. Tripled yearly turnover during same period through crowdfunding and grant writing.
- Co-supervised numerous students at BSc, MPhys and PhD level, taking a hands on approach to teaching practical and theoretical skills.
- Co-founded OpenFlexure Industries a part-time microbusiness that supports distributed manufacturing of open-source hardware.

### Communication Skills:

- Published over 30 peer-reviewed academic papers in fields spanning Metrology, Engineering, Design, Physics, Life sciences, Bio-medicine, Bioethics, and Humanitarian technology.
- Work has been covered by journalists in The Guardian, Nature, and Science. Commissioned to write for specialist magazines including The Conversation and Physics World.
- Experienced public speaker, comfortable presenting to a general audience or presenting technical content at conferences.