

## Dr. Muhammad FIRMANSYAH Kasim

Phone: +447904191891 | Email: [firman.kasim@gmail.com](mailto:firman.kasim@gmail.com) | Blog: <http://mfkasim1.github.io>

### Summary

Strong research professional with a Doctor of Philosophy (DPhil) in Physics from the University of Oxford, focused in Artificial Intelligent applications in physical sciences. Co-founded 2 Oxford spinouts (Machine Discovery [oe](#) and Living Optics [oe](#)) using technologies developed from research. Led a collaborative research work that has been covered in Science Magazine [oe](#) and Nature Physics [oe](#). Main developer of xitorch [oe](#), a differentiable scientific computing library. Contributor of pytorch, numpy, and scipy.

### Employment

- 2019 – present **Co-founder, Machine Discovery Ltd, UK**
- 2019 – present **Co-founder, Living Optics Ltd, UK** [oe](#)
- 2017 – present **Postdoctoral research assistant, University of Oxford, UK (full-time)** [oe](#)

### Education

- 2013 – 2018 **PhD in Physics, Wolfson College, University of Oxford, UK**
- 2009 – 2013 **BSc in Electrical Engineering (*cum laude*), Institut Teknologi Bandung, Indonesia**

### Selected projects

- Jan 2020 – present **Learning universal functional from nature with deep learning**  
On going project on learning universal functional of Density Functional Theory (DFT) using deep learning via differentiable DFT. Wrote a differentiable DFT code [oe](#) as well as the library to complement pytorch in differentiable scientific computing: xitorch [oe](#). Initial results show a good generalization where it can reduce error on the properties prediction by a factor of 2 on molecules never seen during the training.
- May 2019 – Jan 2020 **Building high fidelity emulators with deep neural architecture search**  
Initiated and led the study with a multi-disciplinary collaboration from 4 universities around the world in building accurate emulators for 10 scientific simulations in various disciplines using deep learning. The work was reported by Science Magazine [oe](#), Nature Physics [oe](#), and NVIDIA Developer News [oe](#).
- Jul 2017 – Jun 2019 **Automated inverse problem and uncertainty quantification solver**  
Led the development of a software package containing various algorithms to solve inverse problem, sensitivity analysis, and uncertainty quantification of research tasks involving expensive scientific simulations. The software is used extensively in high energy density science research groups in Oxford Physics and has given significant contributions to several publications. It becomes the basis of a collaboration with Oncology department, University of Oxford, and an Oxford University spin-out company (Machine Discovery Ltd [oe](#)).
- Oct 2015 – Jun 2018 **3D Spectrometer**  
Invented a new type of spectrometer by combining concepts from physics and an advanced computational technique, known as compressed sensing. The novel spectrometer could significantly extend the ability of spectrometer by capturing 2D spatial data as well as 1D spectral data in a single capture using a standard plane detector. It is a granted patent with UK patent no. GB1712357 and becomes the basis of a spin-out company from University of Oxford (Living Optics Ltd [oe](#)).

### Prizes and awards

- Oct 2018 – Mar 2019 **STFC Global Challenge (PI: Dr. Suzie Sheehy, co-I: Dr. Sam Vinko)**  
Awarded £59,140 to apply our technology in optimizing the treatment planning for radiation therapy. Named as a researcher in the proposal. Grant no.: ST/S002197/1.
- May 2018 **Awards for Excellence by University of Oxford**  
Awarded for the University of Oxford employees who have performed well in all the key areas of their jobs and have consistently demonstrated exceptional performance.
- May 2017 – 2018 **STFC Impact Acceleration Account funding**  
Prepared and wrote the proposal that was awarded £16,221.86 to develop a new type of spectrometer from the Science and Technology Facility Council (STFC) UK.

## Dr. Muhammad FIRMANSYAH Kasim

Phone: +447904191891 | Email: [firman.kasim@gmail.com](mailto:firman.kasim@gmail.com) | Blog: <http://mfkasim1.github.io>

### Invited talks

- Science and Technology Facility Council (STFC) SciML Seminar, 11 July 2020.
- Atomic and Laser Physics Seminar, Department of Physics, University of Oxford, 8 July 2020.
- AISC spotlight talk, 26 May 2020.
- ClimateChange.ai workshop at International Conference for Learning Representation (ICLR), 29 April 2020 (as a keynote speaker).
- Perth Machine Learning Group seminar, 9 April 2020.
- Plasma Physics group seminar at Imperial College London, 7 March 2018.

### Publications as first author and last author

- [1] [M. F. Kasim](#), *Derivatives of partial eigendecomposition of a real symmetric matrix for degenerate cases*, arXiv: 2011.04366 (2020). [∞](#)
- [2] [M. F. Kasim](#), D. Watson-Parris, L. Deaconu, *et al.*, *Building high accuracy emulators for scientific simulations with deep neural architecture search*, arXiv:2001.08055 (2020). [∞](#) (news coverage by Science Magazine [∞](#), Nature Physics [∞](#), and NVIDIA Developer News [∞](#))
- [3] D. R. Chowdhury, [M. F. Kasim](#), *Efficient Parameter Sampling for Neural Network Construction*, arXiv:1912.10559 (2019). [∞](#)
- [4] [M. F. Kasim](#), A. F. A. Bott, G. Gregori, S. M. Vinko, *Retrieving field from proton radiography without source profile*, Phys. Rev. E (2019). [∞](#)
- [5] [M. F. Kasim](#), T. Galligan, J. Topp-Mugglestone, G. Gregori, S. M. Vinko, *Inverse problem instabilities in large-scale modeling of matter in extreme conditions*, Phys. Plasmas (2019) [∞](#) and arXiv:1805.08301 (2018). [∞](#)
- [6] [M. F. Kasim](#), J. S. Wark, S. M. Vinko, *Validating Continuum Lowering Models via Multi-Wavelength Measurements of Integrated X-ray Emission*, Scientific Reports (2018). [∞](#)
- [7] [M. F. Kasim](#), S. M. Vinko, P. A. Norreys, and T. Galligan, *Maleo: optimisation framework in distributed system*, University of Oxford's copyright 2018.
- [8] [M. F. Kasim](#), P. A. Norreys, and P. N. Burrows, *3D laser spectrometer*, UK Patent No. GB1712357.
- [9] [M. F. Kasim](#), L. Ceurvorst, N. Ratan, *et al.*, *Quantitative shadowgraphy and proton radiography for large intensity modulations*, Phys. Rev. E (2017) [∞](#) and arXiv:1607.04179 (2016) [∞](#)
- [10] [M. F. Kasim](#) and P. Norreys, *Infinite dimensional optimistic optimisation with applications on physical systems*, BayesOpt workshop at NIPS [∞](#) and arXiv:1611.05845 (2016) [∞](#)

### Other publications

- [1] A. Hasan, H. Susanto, [M. F. Kasim](#), *et al.*, *Superspreading in early transmissions of COVID-19 in Indonesia*, Sci. Rep. **10**, 22386 (2020). [∞](#)
- [2] S. M. Vinko, V. Vozda, ..., [M. F. Kasim](#), ..., H. Zacharias, *Time-Resolved XUV Opacity Measurements of Warm Dense Aluminum*, Phys. Rev. Lett. (2020) (editor's suggestion). [∞](#)
- [3] N. F. Y. Chen, [M. F. Kasim](#), L. Ceurvorst, *et al.*, *Machine learning applied to proton radiography*, Phys. Rev. E (2017) [∞](#) and arXiv:1608.05582 (2016). [∞](#)
- [4] E. Gschwendtner, ..., [M. F. Kasim](#), ..., H. Zhang, *AWAKE, the advanced proton driven plasma wakefield acceleration experiment at CERN*, Nucl. Instrum. Methods A (2016). [∞](#)
- [5] A Caldwell, ..., [M. F. Kasim](#), ..., F. Zimmerman, *Path to AWAKE: Evolution of the concept*, Nucl. Instrum. Methods A (2016). [∞](#)
- [6] L. Ceurvorst, ..., [M. F. Kasim](#), ..., P. A. Norreys, *Mitigating the hosing instability in relativistic laser-plasma interactions*, New Journals of Physics (2016). [∞](#)
- [7] J. D. Sadler, ..., [M. F. Kasim](#), ..., P. A. Norreys, *Compression of X-ray free electron laser pulses to attosecond duration*, Scientific Reports (2015). [∞](#)