

# Excitation and sensorics for high-speed droplet microfluidics

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## Summary

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*Thomas Johann Seebeck Department of Electronics at the School of Information Technologies, Tallinn University of Technology, Estonia, has an opening for a PhD position with the tentative title „Excitation and sensorics for high-speed droplet microfluidics”, as part of the PhD programme Information and Communication Technology.*

Research field:	Information and communication technology
Supervisors:	Dr. Tamas Pardy Ants Koel
Availability:	This position is available.
Offered by:	School of Information Technologies Thomas Johann Seebeck Department of Electronics
Application deadline:	Applications are accepted between June 01, 2020 00:00 and July 03, 2020 23:59 (Europe/Zurich)

## Description

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### CONTEXT

Droplet microfluidics (DM) is a novel discipline in liquid handling that allows the analysis of single particles or cells in chemical isolation. DM is a subset of microfluidics that relies on two-phase flows with immiscible phases, typically oil and an aqueous phase. Each droplet can encapsulate a different set of reagents and single cells, behaving like microreactors. DM flow cytometry (FCM) is a set of technologies that detects and measures chemical or physical characteristics of the droplets. The novel solutions for fluorescence measurements for DM FCM are moving from traditional laser excitation and PMTs detection to LED excitation and 2D CMOS sensor detection. This enables new features, like cell morphology studies, in addition to the traditional cell count. The outstanding issues related to sensors in portable FCM are maximum throughput, maximum flow velocity at which individual cells are discernible, SNR at the required sensitivity levels. Literature examples of droplet MF FCs with LED-camera fluorometers do not exist yet.

### OBJECTIVES

The objectives of the PhD project include:

1. Researching the state-of-the-art as well as cutting edge technologies for implementation in DM FCM devices to overcome the outstanding issues listed above.
2. Address scientific and technical issues, to implement LEDs and LDs as excitation sources and 2D sensors as detectors, including accompanying development of signal processing algorithms and solutions for DM FCM as part of project PRG620.

### QUALIFICATIONS

- MSc in the field of electrical engineering, physics, or similar discipline
- Excellent communication and writing skills in English
- Prior knowledge of electronics design is preferable
- Previous experience in at least one of the following: optics design, embedded programming (C/C++), CAD design (AutoCAD or SolidWorks), FEM (Comsol Multiphysics)
- No previous experience in optics or microfluidics is necessarily expected, but is a bonus

Tallinn University of Technology is an equal opportunity university. Female applicants are particularly encouraged to apply.

### CONTACTS

- Supervisor Ants Koel, ants.koel@taltech.ee
- Co-supervisor Tamas Pardy, tamas.pardy@taltech.ee

### REFERENCES

- 'ZEISS Microscopy Online Campus | Light-Emitting Diodes'. <http://zeiss-campus.magnet.fsu.edu/articles/light-sources/leds.html> (accessed Apr. 01, 2020).
- A. M. Esmaeel, T. T. H. ElMelegy, and M. Abdelgawad, 'Multi-purpose machine vision platform for different microfluidics applications', Biomed. Microdevices, vol. 21, no. 3, p. 68, Jul. 2019, doi: 10.1007/s10544-019-0401-1.



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