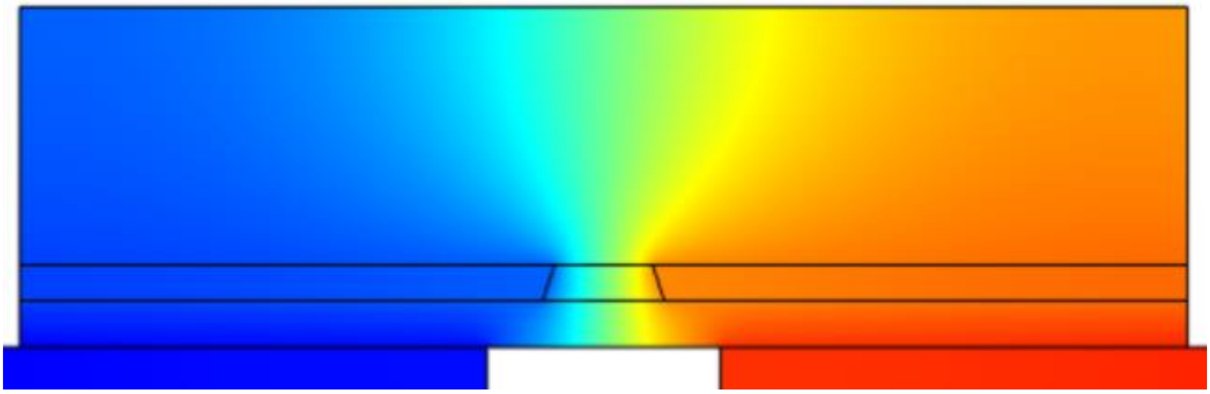
TIME: HOW TO STOP THIS SERIAL KILLER



Late diagnosis implies countless early deaths. How can sound and heat help us tackling this problem? To find out we need to dive into the micro-scale world.

Modern society has indeed a lot of advantages, but humans must face diseases that were quite unlikely only a few hundreds years ago. Aging and pollution brought us widespread tumours, massive use of antibiotics created “super bacteria” and alive animal markets in urban areas gave us new vira, as nowadays news and everyday life sadly remind us. Luckily, technology comes in our help and especially microfluidics, the main field of this study, will have a key role in tackling these and many more health-related issues all around the world. The term is quite self-explanatory: *micro-* refers to small dimensions, while *-fluidic* to fluids of course. It has many advantages, among which low costs, high automatization and reproducibility are the most impactful.

Our work focuses on the use of travelling pressure waves and heat in microfluidic devices. While the latter ingredient is straight forward, the former one is simply a scientific term referring to sound: this has already been proven to be an effective method to move objects suspended in fluids, such as cells in blood. Thanks to the gentle and non-contact manipulation, this technique, also known as *Acosutofluidics*, has become more and more widespread as a diagnostic and research tool, enabling precise and fast single cell identification. It has of course limitations, like the fact that is not possible to identify really small objects (roughly below one micron, i.e. one thousandth of a millimetre). In this context, it arises the necessity to find other strategies aiming to make this promising technology more effective. As several research pointed out, differences in physical properties within the microchannel generates forces once an acoustic field is applied. One of the easiest ways to generate such condition is to have the same liquid at different temperatures (and thus different densities).

This thesis explores the interaction between a sound field inside an acoustic resonator with differently heated side walls. We first characterized the acoustic behaviour inside a microfluidic device and compared it with references in literature. Then, we studied the fluid motion when a thermal field was added to the system, showing great velocity increase with just few degrees Celsius across. Besides of this, we could not state anything certain about this phenomenon. We had nonetheless developed a platform to build, maintain and map a temperature difference within a microfluidic device. Further investigation is needed to get reliable data on the fluid motion when combining these two physical fields into a sub-millimetric channel. This research might eventually lead to some method able to isolate small suspended objects quickly and directly from patients’ blood, making diagnosis of bacterial and viral diseases cheap, easy and thus spread all across the world.