Fluids on the small scale - opportunities for sound innovations in infectious disease diagnostics

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Despite important improvements in prevention and treatment over the last decades, infectious diseases still represent a major threat to human health worldwide, with a significant impact on economies globally. To reach the ambitious goals set by the WHO towards elimination of diseases such as Malaria or sleeping sickness (Human African Trypanosomiasis - HAT) in the next two decades. This work presents a new set of diagnostic tools to respond to emerging threats, with the potential to provide critical benefits on at least three fronts:

1. The tests can be carried out in a decentralised fashion, at the 'point-of-care', to increase coverage and speed.
2. They are set to provide high sensitivities to enable early diagnostics and potentially the discovery of asymptomatic carriers, which in the case of HAT translates into the detection of less than 100 parasites/ml.
3. They can access more information, for example through genetic typing or access to drug resistance susceptibility.

Here we show how acoustic technologies have provided us with a route towards addressing these challenges. In the form of Surface Acoustic Waves (SAW), the mechanical energy carried by sound has allowed us to enrich specific cells and parasites from blood samples and extract and amplify their DNA for diagnosis. Using the novel technology of phononics, akin to holograms for light, we shape sound waves on low-cost disposable devices, to integrate all necessary diagnostic functions in a 'point-of-care' device. This presentation will also discuss recent developments in paper-based diagnostic platforms.