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High speed dynamic characterization of an *E. coli* population using advanced optical methods (DDM and DFM) RONGJING ZHANG, LAURENCE WILSON, Rowland Institute at Harvard Univeristy — The motility of microbes/bacteria in a complex environment, especially the average motility of the whole group of microorganisms, is directly related to behavior such as virulence, biofilm formation, etc. It is challenging to use traditional tracking methods to quantify the average motility of a large population. It is even more challenging when the environment is constantly changing. Two optical methods were developed to solve the problem: differential dynamic microscopy (DDM) and dark field flickering microscopy (DFM). The key features of bacteria motility were quantified automatically: average swimming speed, motile fraction, diffusion coefficient, cell body rotation speed and flagellar bundle rotation speed. This method is able to measure $\sim 10^4$ cells simultaneously. With the help of a high speed camera, the timescale of the dynamic measurement can be in a wide range from 10^{-4} s to 10^5 s. Using this tool, temperature effects on *E. coli* motility were studied. Potential biomedically-relevant applications will also be discussed.

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