

# An optically pumped magnetometer for counting magnetotactic bacteria

Tino Fremberg, Volkmar Schultze, Florian Wittkämper, Mark Kielpinski, Thomas Henkel, and  
Ronny Stolz

Leibniz Institute of Photonic Technology, P.O. Box 100239, D-07702 Jena, Germany

Magnetotactic bacteria (MTB) are aquatic bacteria with the ability to grow single domain magnets, so called magnetosomes. They contribute significantly to the micro-biotic biomass of our planet and are involved in environmental cycles of iron, sulfur, nitrogen and carbon [1]. After their death, the MTB remain magnetic, so their remainders can be used as markers for paleomagnetism and archaeology. In order to gain more information about their abundance and distribution on planet Earth, we want to examine water samples via automated single detection of MTB by means of microfluidics and optically pumped magnetometers (OPM). The very small magnetic moment of the bacteria ( $10^{-15}$  Am<sup>2</sup>) leads to challenging demands on our OPM, such as high sensitivity, small volume, and close proximity to the measurement object. We present parameter studies of cell geometry as well as of a pump-probe scheme, in order to gain the best suited OPM for the goal of detecting single MTB.

[1] A. C. V. Araujo, F. Abreu, K. T. Silva, D. A. Bazylinski, and U. Lins, Magnetotactic Bacteria as Potential Sources of Bioproducts, *Mar. Drugs* **13**, 389-430 (2015).