



**Supplementary Movie 1. Rotation of a fluorescent bead bound to an archaellum.** A bead image was split in two (cyan and red in the *Left panel*) as shown in Fig. 1C, and integrated into one image (*Right*). The height of the bead from the glass surface is greatest when the two images superimpose as shown in *Right panel* (appearing white); the images of lower beads do not align, and the height can be calculated from the displacement of the twin images. The 3-D trajectory of bead rotation can be reconstructed from the relative displacement between the center positions of the two images. Scale bar, 1  $\mu\text{m}$ .