Alignment statistics of rods with the Lagrangian stretching direction in a turbulent channel flow ANSHUMAN DUBEY[1], University of Gothenburg, ZHIWEN CUI, LIHAO ZHAO, Tsinghua University, BERNHARD MEHLIG, University of Gothenburg — We study the alignment of slender rods with the Lagrangian stretching direction in a turbulent channel flow. Our objective is to understand how the distribution of relative angles between a rod and the Lagrangian stretching direction depends on the aspect ratio of the rod and upon the distance of the rod from the channel wall. We find that this distribution exhibits a plateau at small relative angles, and power-law tails at large relative angles. A plateau in the distribution of the relative angle corresponds to random uncorrelated motion. Power-law tails in the distribution result from large excursions. Slender rods near the channel centre are found to align better with the Lagrangian stretching direction compared with those near the channel wall. These observations are explained in terms of simple statistical models based on Jeffery's equation. Near the channel centre we use a two-dimensional toy model which explains the qualitative mechanisms at play. By contrast,near the channel wall, we find quantitative agreement between the statistical model calculations and simulations.

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