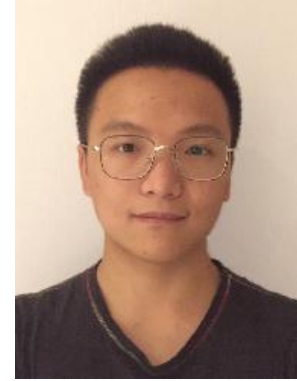


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“Understanding the 3D collective behaviour of zebrafish”

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Large aggregations of animals that present complex patterns are frequently observed in natural environments, such as flocking birds or schooling fish. These strikingly coordinated and complex movements, however, can be modelled effectively by very simple models. [1] These simple models, originated from describing bird behaviours, indeed captured the essence of collective behaviours at different length scales, including the bacteria, the insects and the birds. [2] Further extending the idea, we studied the collective behaviour of zebrafish and compared our observations with some simple models. Typically, we observed 50 zebrafish swimming and calculated their 3D trajectories using computer vision techniques. The result were analysed using the tools from statistical physics such as the correlation functions. We found the zebrafish started from a disturbed state and gradually relaxed to a steady state when they were introduced to a new environment. A careful study on the state change of the fish yields a universal relationship between the group polarisation and the number of connected neighbours. These results provided deeper insights into the zebrafish behaviour, which are expected to help us understanding the genetic origin of different behavioural functions. [3]

[1] Vicsek, T., CZIROK, A., BENJACOB, E., COHEN, I. & SHOCHET, O. Phys. Rev. Lett. 75, 1226–1229 (1995).

[2] Vicsek, T. & Zafeiris, A. Physics Reports 517, 71–140 (2012).

[3] da Silva, R. S. et al. biorxiv 9, 2020.06.07.138909 (2020).