Active matter flocking via predictive alignment

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Understanding collective self-organization in active matter, such as bird flocks and fish schools, remains a grand challenge in physics. Alignment interactions are essential for flocking, yet alone, they are generally considered insufficient to maintain cohesion against noise, forcing traditional models to rely on artificial boundaries or added attractive forces. Here, we report a model to achieve cohesive flocking using purely alignment interactions, introducing predictive alignment: agents orient based on the predicted future headings of their neighbors. Implemented in a discrete-time Vicsek-type framework, this approach delivers robust, noise-resistant cohesion without additional parameters. In the stable regime, flock size scales linearly with interaction radius, remaining nearly immune to noise or propulsion speed, and the group coherently follows a leader under noise. These findings reveal how predictive strategies enhance self-organization, paving the way for a new class of active matter models blending physics and cognitive-like dynamics.