Collective behaviour of self-propelling particles with conservative kinematic constraints

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Stellingen

behorende bij het proefschrift

Collective Behaviour of Self-Propelling Particles with Conservative Kinematic Constraints

Valeriya Ratushna, 27 september 2007

1. The essence of the emergence of coherent motion is the tendency of self-propelling particles to align their velocities with the neigbouring particles.

   Dit proefschrift, Hoofdstukken 2 en 5;
   T. Vicsek, A. Czirók, E. Ben-Jacob, I. Cohen and O. Shochet, *Phys. Rev. Lett.* **75**, 1226 (1995).

2. The obtained density dependence of the velocity distribution is caused by the nature of the interactions between self-propelling particles.

   Dit proefschrift, Hoofdstuk 2.

3. The vortical flow profiles obtained in the local hydrodynamic model are found to be similar to those obtained by Vicsek et al.

   Dit proefschrift, Hoofdstukken 2 en 3.

4. The neutral stability of the stationary flows is caused by the conservation of the kinetic energy.

   Dit proefschrift, Hoofdstuk 4.

5. Coherent motion in bacterial colonies is most likely driven by external factors, rather than by non-potential interparticle interactions.

   S. Camazine, J.-L. Deneubourg, N.R. Franks, J. Sneyd, G. Theraulaz, E. Bonabeau, *Self-Organization in Biological Systems* (Princeton and Oxford: Princeton University Press, 2001).

6. The use of phenomenological extensions of the Navier-Stokes equation to describe coherent motion of self-propelling particles lacks a sufficient physical justification.

   See, e.g. J. Toner, Y. Tu, *Phys. Rev. E* **58**, 4828 (1998).

7. The consideration of particles with different speeds is unnecessary for the construction of a minimal model of collective motion of self-propelling particles.

   See, e.g. S. Hubbard, P. Babak, S.T. Sigurdsson, K.G. Magnusson, *Ecol. Model.* **174**, 359 (2004).

8. In contrast to what is stated by Gazi et al., the swarming behaviour of self-propelling particles is not due to the interplay between a long range attraction and a short range repulsion between the particles, but the result of the interactions of a non-potential character.

   V. Gazi, K. Passino, *IEEE transactions on automatic control* **48**, 692 (2003).

9. The smallness of the fluctuation region in Coulombic systems is possibly explained by the presence of a tricritical point.

   V. L. Kulinskii, N. P. Malomuzh, *Phys. Rev. E.* **65**, 061506 (2002).

10. Een beetje te veel chocola is precies genoeg.

11. When words fade music flourishes.