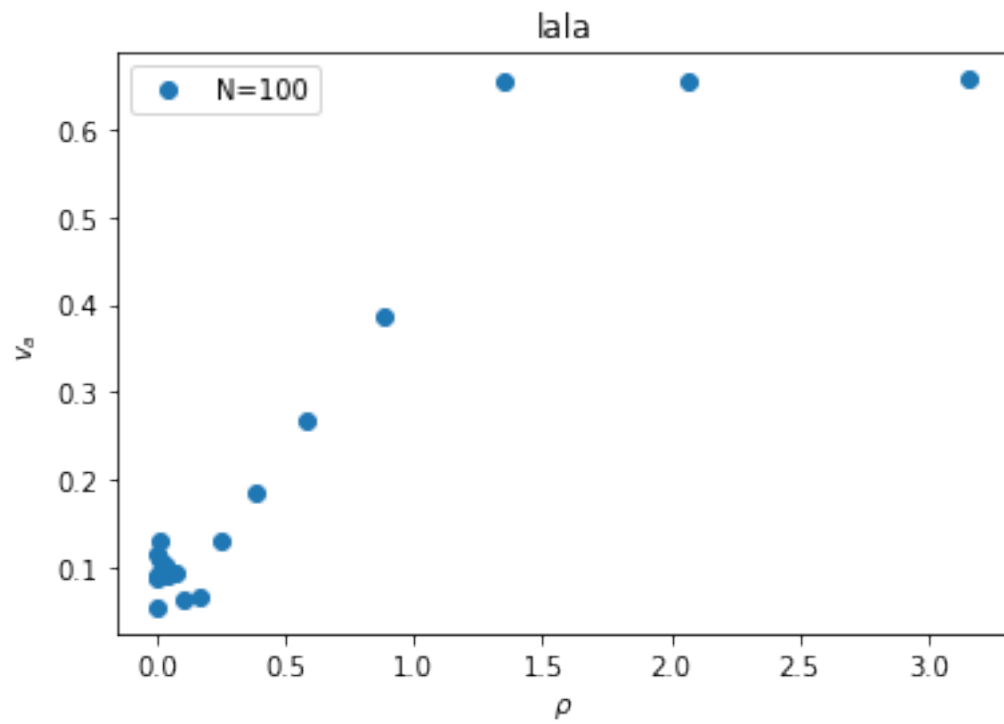


Title

Steffen Randrup

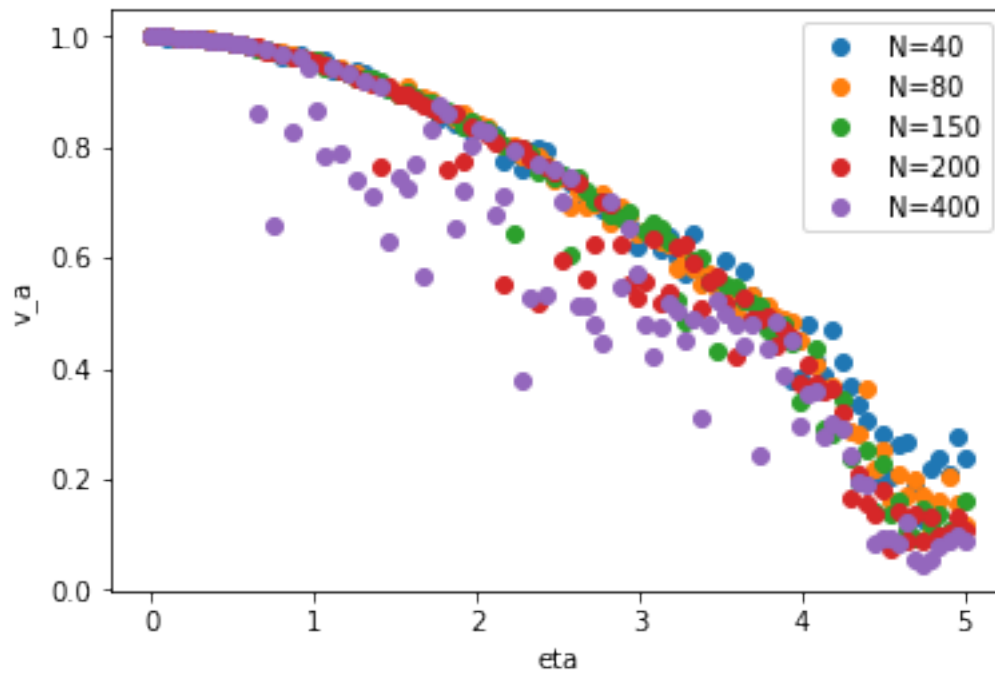
16. oktober 2017

Alignment depends on density. This is similar to the graph in the original paper by Vicsek

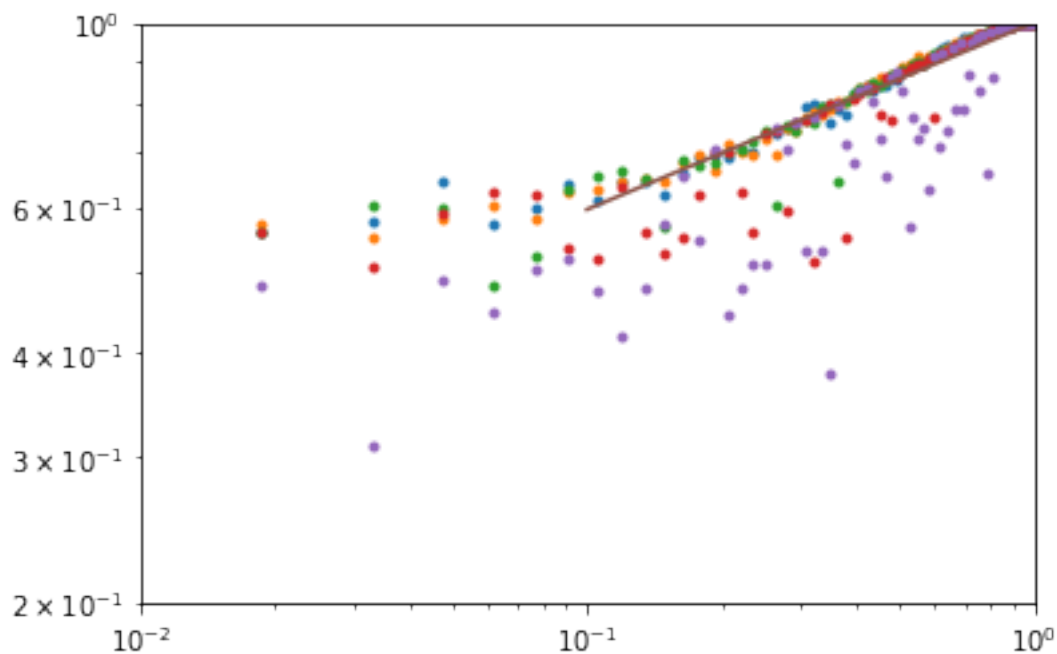


Alignment depends on randomness of motion. The graph overall looks like the one in the Vicsek paper. It sort of has the "tail", but we didn't run it with N large enough to show properly. But one can get a feel for it around the end.

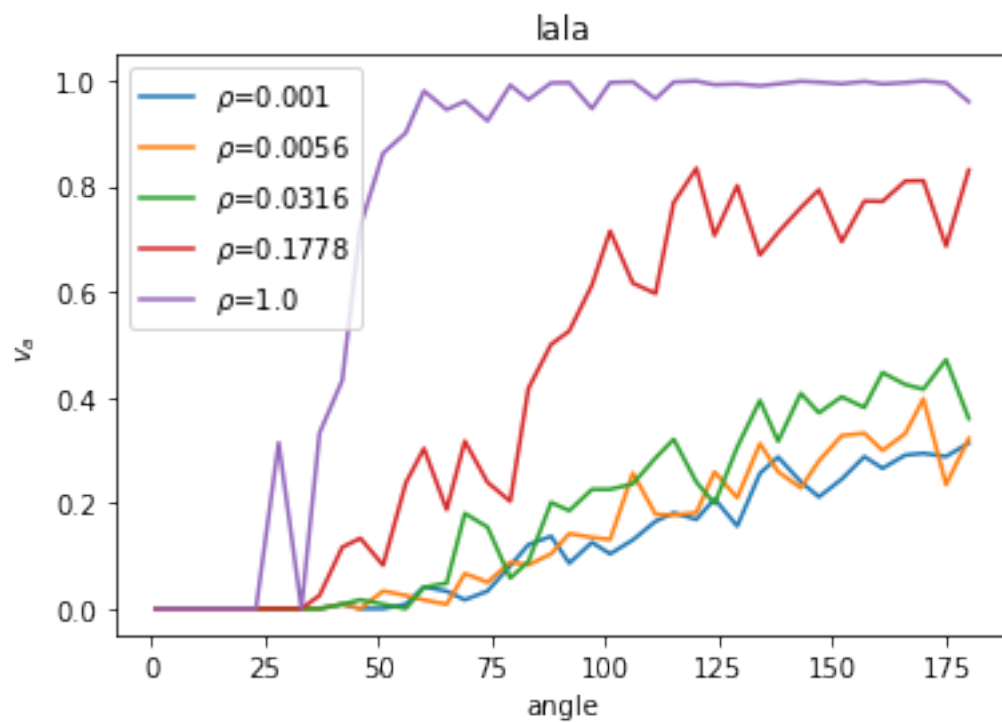
The purple dots don't stick that well to the curve. This is probably because, the alignment reduces when groups collide. This happens more frequently for larger numbers. We have not taken any measures to avoid this.



The slope in the log plot is about half that of Vicsek's

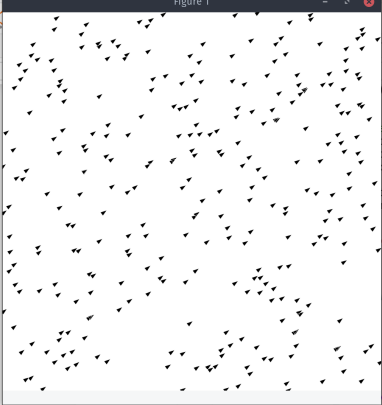


Alignment when varying angle of cone-like vision. The effect is only visible at low densities and randomness. Density is varied in graph, randomness η is set to 0.1



[illegible]

High density low randomness



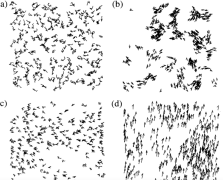
```

34 ca = plt.gca()
35 ca.set_xscale('log')
36 ca.set_yscale('log')
37
38 def va_crit(eta_e, beta):
39     return ((eta_c - eta_e)/eta_c)**beta
40
41 popt, pcov = curve_fit(va_crit, Eta, va[-1])
42 print(popt, np.sqrt(pcov))
43 #plt.plot( (eta_c-Eta)/eta_c, va_crit(Eta, popt[0]))
44
45 x = np.logspace(-1, 0, 10)
46 y = x**0.225 #popt[0]
47 plt.plot( x, y )

```

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The actual simulations were carried out in a square shaped cell of linear size L with periodic boundary conditions. The particles were represented by points moving continuously (off lattice) on the plane. We used the interaction radius r as the unit to measure distances ($r = 1$), while the time unit $\Delta t = 1$ was the time interval between two updtings of the directions and positions. In most of our simulations we used the simplest initial conditions: (i) at time $t = 0$, N particles were randomly distributed in the cell and (ii) had the same absolute velocity v and (iii) randomly distributed directions θ . The velocities $\{v_i\}$ of the particles were determined simultaneously at each time step, and the position of the i th particle updated according to

$$\mathbf{x}_i(t+1) = \mathbf{x}_i(t) + \mathbf{v}_i(t)\Delta t. \quad (1)$$


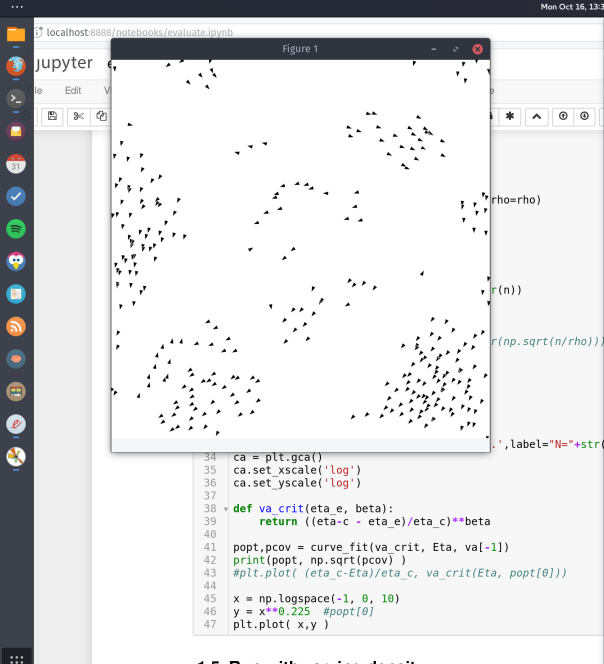
123:python - "python"
 ~Documents/Skole/From Idea to Result/idea2birds/src
 python birds.py --radius 1 --v 0.83 -n 300 -l 5 --eta 0.1 --scale 90
 [t: Session management error: Could not open network socket

$v \rightarrow 0$ the particles do not move and the model becomes an analog of the well-known XY model. For $v \rightarrow \infty$ the particles become completely mixed between two updates.

This kinetic phase transition is due to the fact that the particles are driven with a constant absolute velocity;

1.5 Run with varying density

Low density low randomness

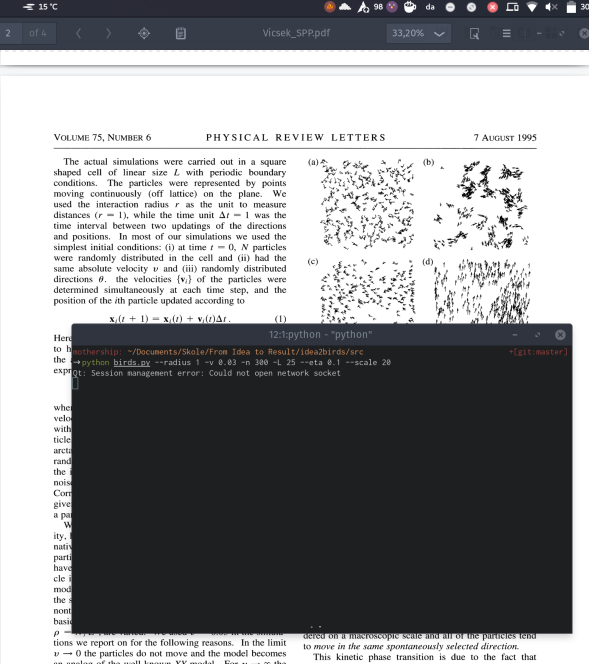


```

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35 ca.set_xscale('log')
36 ca.set_yscale('log')
37
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43 #plt.plot( (eta_c-Eta)/eta_c, va_crit(Eta, popt[0]))
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```

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$$\mathbf{x}_i(t+1) = \mathbf{x}_i(t) + v_i(t)\Delta t. \quad (1)$$

Here we report on for the following reasons. In the limit $v \rightarrow 0$ the particles do not move and the model becomes an analog of the well-known XY model. For $v \rightarrow \infty$ the particles become completely mixed between two updates.

When the random absolute velocities become the same, the particles tend to move in the same spontaneously selected direction. This kinetic phase transition is due to the fact that the particles are driven with a constant absolute velocity;

12:1python - "python"
to bash: ~/Documents/Skole/From Idea to Result/idea2birds/arc
python birds.py --radius 1 --v 0.03 --n 300 --L 25 --eta 0.1 --scale 20
exp: Session management error: Could not open network socket