1. Introduction
What is “jammology”? A new research field of jammology is an interdisciplinary study of congestion phenomena ranging from vehicles, pedestrians, insects and internet traffic, etc. We consider all these movable objects as “self-driven particles”, and study collective phenomena of these particles by using statistical physics and mathematics as well as computer simulations.

2. A simple model
To study jamming phenomena, we employ a simple model called ASEP, which is the abbreviation of “asymmetric simple exclusion process”. This is a very simple mathematical model, but powerful to study all kinds of jams. We consider an array of cells as given below, and assume that each cell can accommodate at most one ball. A ball can move to the right cell if it is not occupied by another ball. Repeating this procedure, we see jams of balls if the number of balls is sufficiently large. We use this model as a basis for considering traffic flow of vehicles, pedestrians, ants and so on.

3. Experiments
Jams of several kinds of self-driven particles are investigated both theoretically and experimentally. Some pictures of such experiments are given below.
Conclusion
Jammology is interdisciplinary research among mathematics, physics and Engineering. We study the jamming phenomena not only by computer simulations, but also using mathematics since it is very important to obtain rigorous results. We also consider that it is very important to do experiments and collect real data for mathematical modeling. We now extensively study jammology and collaborate with some companies to reduce traffic jams in Tokyo and stress of being involved in jams.

References

Vehicles

Pedestrians

Ants

Protein (molecular motor)