In this issue: Bumblebee Flight in Turbulence, Testing General Relativity in a Black Hole’s Shadow, Swarming Robots

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Bumblebees Flight in Turbulence

Simulations reveal that bumblebees and other flapping-wing fliers don’t work harder than usual in turbulent conditions.

Air turbulence can disrupt the smooth flight of an airplane. However, it is not clear how it affects the motion of flapping-wing fliers like insects. A group of physicists from France, Germany and Japan has simulated the flight of a bumblebee in turbulence. Surprisingly, their simulations suggested the bumblebee doesn’t require more force or exert more energy to stay aloft in turbulent airflow as compared to smoother, laminar flow. The flapping wings of the bumblebee remain efficient even under severe turbulent conditions that would be problematic for fixed-wing fliers. The results could benefit the design of bug-sized drones.

* T. Engels, D. Kolomenskiy, Kai Schneider (contact author) et al., “Bumblebee flight in heavy turbulence,” Physical Review Letters (expected publication date: Jan 15)

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Testing General Relativity in a Black Hole’s Shadow

Observations of the “shadow” of a supermassive black hole could uncover violations of general relativity.
The Event Horizon Telescope (EHT), a network of radio telescopes, is compiling the first images of the Milky Way's supermassive black hole, Sagittarius A*. While the black hole itself is strictly invisible, the EHT aims to observe its “shadow,” a faint ring of light produced by matter at the edge of the event horizon. According to general relativity, the shadow should have a precise size and shape. A new analysis by a team of researchers from Canada, Germany, and the U.S. shows that the EHT will have sufficient resolution to detect small deviations in the shadow size that are predicted by alternative theories of gravity. The EHT could thus test Einstein's theories where they are most likely to break down—in the vicinity of a black hole.

* Tim Johannsen (contact author) et al., “Testing general relativity in the shadow size of Sgr A*,” *Physical Review Letters* (expected publication date: Jan 19)

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**Swarming Robots**

Researchers have engineered robots that cluster together or disperse based on the delay between when they sense light and when they react to it.

Animals spontaneously organize into swarms by simply reacting to their immediate neighbors. This collective behavior has the evolutionary advantage of being robust even if individuals are removed or added from the system. Inspired by nature, a team of researchers from Turkey and the U.S. has designed an ensemble of robots whose collective behavior can be tuned from clustering to dispersion by changing only one parameter: the time delay between when the robots receive and react to signals of light. These findings could be exploited, for example, in search-and-rescue missions where robots are tasked with first dispersing widely to search a large area and then clustering together to share data.

* M. Mijalkov, A. McDaniel, J. Wehr and Giovanni Volpe (contact author), “Engineering sensorial delay to control phototaxis and emergent collective behaviors,” *Physical Review X* (expected publication date: Jan 29)

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