Contribution ID: **258** Contribution code: **S1 Physics Innovation** Type: **Oral Presentation**

Modeling the navigation of a weaver ant in a simple, unfamiliar environment

Friday 24 June 2022 15:30 (15 minutes)

The ant species Oecophylla smaragdina, commonly known as the weaver ant, is native to tropical Asia and Africa. Ants are known for highly-organized, co-operative behavior and weaver ants are particularly adept at working together, in numbers, to accomplish large-scale tasks. Considered an example of a coherent many-body system, weaver ants have been studied by researchers in various fields. As a first step towards understanding weaver ant coordinated motion, we want to find the algorithm that a single ant employs for its own navigation. Having previously tracked the motion of individual ants within a small, bounded arena, we here present a simple theoretical model that can describe this motion. We show that their navigation can be adequately modeled as Brownian motion: the ant velocity changes by random impulses drawn independently from a robust probability distribution. Using establish Brownian motion theory, we show that the ant's tendency to remain near boundaries can be explained as a result of pure chance: having been stopped at the boundary, random motion is unlikely to bring the ant back to the arena interior. All qualitative aspects of ant motion are captured by a model with few parameters and without any assumption that an ant has preferences for position or velocity.

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Session Classification: S1 Physics Innovation

Track Classification: Physics Innovation