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NeuroPhysics: Studying how neurons create the perception of space-time using Physics' tools and techniques SHONALI DHINGRA, ROMAN SANDLER, RODRIGO RIOS, CLIFF VUONG, Dept of Physics and Astronomy, University of California - Los Angeles, MAYANK MEHTA, Dept of Physics and Astronomy, Dept of Neurology, Dept of Neurobiology, University of California - Los Angeles — All animals naturally perceive the abstract concept of space-time. A brain region called the Hippocampus is known to be important in creating these perceptions, but the underlying mechanisms are unknown. In our lab we employ several experimental and computational techniques from Physics to tackle this fundamental puzzle. Experimentally, we use ideas from Nanoscience and Materials Science to develop techniques to measure the activity of hippocampal neurons, in freely-behaving animals. Computationally, we develop models to study neuronal activity patterns, which are point processes that are highly stochastic and multidimensional. We then apply these techniques to collect and analyze neuronal signals from rodents while they're exploring space in Real World or Virtual Reality with various stimuli. Our findings show that under these conditions neuronal activity depends on various parameters, such as sensory cues including visual and auditory, and behavioral cues including, linear and angular, position and velocity. Further, neuronal networks create internally-generated rhythms, which influence perception of space and time. In totality, these results further our understanding of how the brain develops a cognitive map of our surrounding space, and keep track of time.

Shonali Dhingra
University of California - Los Angeles

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