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# Slow global population dynamics propagating through the medial entorhinal cortex

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The medial entorhinal cortex (MEC) supports the brain's representation of space with distinct cell types whose firing is tuned to features of the environment (grid, border, and object-vector cells) or navigation (head-direction and speed cells). While the firing properties of these functionally-distinct cell types are well characterized, how they interact with one another remains unknown. To determine how activity self-organizes in the MEC network, we tested mice in a spontaneous locomotion task under sensory-deprived conditions. Using 2-photon calcium imaging, we monitored the activity of large populations of MEC neurons in head-fixed mice running on a wheel in darkness, in the absence of external sensory feedback tuned to navigation. We unveiled the presence of motifs that involve the sequential activation of cells in layer II of MEC (MEC-L2). We call these motifs waves. Waves lasted tens of seconds to minutes, were robust, swept through the entire network of active cells and did not exhibit any anatomical organization. Furthermore, waves did not map the position of the mouse on the wheel and were not restricted to running epochs. The majority of MEC-L2 neurons participate in this global sequential dynamics, that ties all functional cell types together. We found the waves in the most lateral region of MEC, but not in adjacent areas such as PaS or in a sensory cortex such as V1

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