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## Visual alpha generators in a full-density spiking thalamocortical model

*Friday 16 June 2023 09:35 (20 minutes)*

The alpha rhythm (~10 Hz) is a prominent feature in the electroencephalograms of various mammals and is associated with reduced visual attention and with functions such as timing regulation and transmission facilitation [1]. Although the exact mechanism of alpha rhythm generation is still unclear, the thalamus and cortex have been proposed as possible protagonists. In this study, a full-density spiking thalamocortical model of neural circuits in the primary visual cortex and the lateral geniculate nucleus was built using the NEST simulator, to investigate two potential alpha rhythm generators. The first mechanism involves rhythmic bursts produced by pyramidal neurons in layer 5 at around 10 Hz [2], while the second mechanism relies on a thalamocortical loop delay of approximately 100 ms [3]. The model comprises excitatory and inhibitory populations of adaptive exponential integrate-and-fire model neurons. The resulting spiking activity was recorded and compared with experimental data using power spectra and Granger causality analysis. The results indicate that both mechanisms can generate and spread alpha oscillations but with different laminar patterns. The first mechanism suggests that the alpha rhythm mainly originates in layers 5 and 2/3 (similar as in [4]), while the second mechanism points to layers 4 and 6 (similar as in [5]). Combining both mechanisms results in a summation of effects, with the alpha range emanating from all layers. The findings suggest that the two mechanisms may contribute differently to alpha rhythms, with distinct laminar patterns, and may be expressed either separately or in tandem under different conditions.

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### Topic area

models and applications

### Keywords

microcircuit model, thalamocortical oscillations, alpha rhythm, visual cortex

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