سمینارهفتگی ماده چگال نرم

Auditory event-related fields emerging from the network structure of the auditory cortex

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چکیده

Auditory stimuli evoke a series of peaks and troughs in the eventrelated fields (ERF) of the magnetoencephalogram (MEG). These deflections reflect not only stimulus properties but also the subject-specific cortical topography. While the general biophysics of the generation of the MEG signal is well understood, what the ERF represents has remained obscure. The common view suggests that the ERF waveform is a linear combination of the activity of spatially distributed generators in the brain. However, this view might just reflect the limitations of current imaging techniques rather than the actual state of affairs. Here, we introduce a computational model of the auditory cortex (AC) which addresses this issue. Our starting point is an already existing non-linear model which is based on the anatomical core-belt-parabelt structure of the AC. The computational unit is a simplified description of the cortical column comprising one excitatory and one inhibitory cell population, each characterized by a mean spiking rate. The dynamics of the model are described by two sets of 240 coupled non-linear differential equations. We developed analytical solutions for this system by linearizing the equation for the spiking rate and by introducing symmetric connections between the columns. The latter allowed us to simultaneously diagonalize the matrices determining the decay constant and angular frequency. Our analytical model captures the dynamics of the AC in terms of uncoupled damped harmonic oscillators (normal modes). In this view, ERFs are characterized by coupling of normal modes, whereby each depending directly on the entire set of connection pattern and connection strength of the system. With this approach, ERFs are no longer determined by discrete response generators in the AC but, rather, the ERF emerges as a network property of the entire AC.

زمان :شنبه ۹۷/۱۰/۱۵ ساعت ۱۵:۳۰

مکان: تالاردکترجناب دانشکده فیزیک