Contribution ID: **1298** Type: **Invited Speaker / Conférencier invité**

Nonlinear dynamics of sensory focussing

Tuesday 14 June 2016 13:45 (30 minutes)

This talk will discuss a non-conventional neural coding task that may apply more broadly to many senses in higher vertebrates. We ask whether and how a non-visual sensory system can focus on an object. We present recent experimental and modeling work that shows how the electric sense can perform such neuronal focussing. This sense is the main one used by weakly electric fish to navigate, locate prey and communicate in the murky waters of their natural habitat. We show that there is a distance at which the Fisher information of a neuron's response to a looming and receding object is maximized, and that this distance corresponds to a behaviourally relevant one chosen by these animals. Strikingly, this maximum occurs at a bifurcation between tonic firing and bursting. We further discuss how the invariance of this distance to signal attributes can arise, a process that first involves power-law spike frequency adaptation. The talk will also highlight the importance of expanding the classic dual neural encoding of contrast using ON and OFF cells in the context of looming and receding stimuli.

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Session Classification: T2-2 Nonlinear Dynamics (DPMB) / Dynamiques non linéaires (DPMB)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)