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MEETING ABSTRACT

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**GABAergic neurons coordinate hippocampal information  
processing through diverse gamma oscillations**

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**Background:** During exploratory behaviour in rodents, electrical activity of the hippocampus is characterised by continuous ~ 10 Hz (theta) oscillations. Fast oscillations in the gamma frequency range (30–150 Hz) co-occur with theta oscillations and emerge as transient bouts of a few waves, nested into ongoing theta cycles. Recent evidence in rats and mice revealed multiple hippocampal gamma oscillations of distinct spectral distribution, theta-phase preference, and spatial localisation along anatomical layers. Gamma oscillations are instrumental in coordinating the information transfer from intra- and extrahippocampal afferents to the place cells of the CA1 hippocampus. We addressed the contribution of a diverse population of GABAergic cells within the CA1 area in implementing gamma oscillations.

**Methods:** Experiments were done in drug-free head-restrained mice actively navigating a linear corridor in a virtual reality environment for a small water reward. We recorded local field potentials from multiple, equally spaced locations along the radial axis of hippocampal CA1 and dentate gyrus using linear silicon probes. Different gamma oscillations were separated and localised to anatomical layers by calculating current source densities. Concomitantly, we recorded the spiking activity of one or several putative GABAergic cells using glass electrodes or multi-shank silicon probes, and examined their entrainment by the different gamma oscillations.

**Results:** Our data revealed a marked heterogeneity of GABAergic cells with respect to their entrainment by different hippocampal gamma oscillations. GABAergic neurons displayed distinct phase-coupling profiles to the three gamma oscillations, and showed different phase preferences to single gamma oscillations within the CA1 area. Our preliminary data based on axonal and dendritic arborisations and protein expression suggest that patterns of modulation by gamma oscillations are correlated to cell type classification.

**Discussion:** Our data suggest that the evolutionary diversity of GABAergic cells is aligned to the diversity of gamma oscillations to support hippocampal information processing.

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