

FELIX: 40 Hz Masked Flickering Light as a Potential Treatment of Major Depressive Disorder

Authors : Nikolas Aasheim, Laura Sakalauskaite, Julie Dubois, Malina Ploug Larsen, Paul Michael Petersen, Marcus S. Carstensen, Marcus S. Carstensen, Mai Nguyen, Line Katrine Harder Clemmensen, Kamilla Miskowiak, Klaus Martiny

Abstract : Background: Major depressive disorder (MDD) is a debilitating condition that affects more than 300 million people worldwide and profoundly impacts well-being and health. Current treatments are based on a trial-and-error approach, and reliable biomarkers are needed for more informed and personalized treatment solutions. One potential biomarker is aberrant gamma-frequency (30-80 Hz) brainwaves, hypothesized to originate from deficiencies in the excitatory-inhibitory interaction between the pyramidal cells and interneurons. An imbalance within this interaction is described as a crucial pathological mechanism in various neuropsychiatric conditions, including MDD, and the modulation of this pathological interaction has been investigated as a potential target. A specific type of steady-state visually evoked potential (SSVEP) in the gamma frequency band, referred to as gamma entrainment using sensory stimuli (GENUS), particularly around the 40Hz spectrum, entrains large scale, fast-spiking PV+ interneurons, facilitating coordinated activity in key brain regions, reduced neuronal and synaptic loss, and enhanced synaptic stability and plasticity. GENUS has shown promise in improving sleep, offering neuroprotective effects in Alzheimer's disease (AD), and reducing pathological markers like Amyloid Beta and TAU proteins, as seen in animal models. In this study, we explore the antidepressant, cognitive, and electrophysiological effects of a novel, non-invasive brain stimulation (NIBS) approach utilizing a 40 Hz invisible spectral flicker to induce gamma activity in patients diagnosed with Major Depressive Disorder (MDD). This non-invasive targeted stimulation of lower gamma band activity (40 Hz) is designed to modulate neural circuits associated with mood and cognitive functions, providing a potential new therapeutic avenue for MDD. Methods and Design: 60 patients with a current diagnosis of a major depressive episode will be enrolled in a randomized, double-blinded, placebo-controlled trial. The active treatment group will receive 40 Hz invisible spectral flickering light stimulation while the control group will receive continuous light matched in colour temperature and brightness. Patients in both groups will get an hour of daily light treatment in their own homes and will attend four follow-up visits to assess depression severity measured by Hamilton Depression Rating Scale (HAM-D₆), several aspects of sleep, cognitive function, quality of life. Additionally, exploratory EEG is conducted to assess spectral changes throughout the protocol. The primary endpoint is the mean change from baseline to week 6 in depression severity (HAM-D₆ subset) between the groups. Current state of affairs/timeline: The FELIX study was initiated in the beginning of 2022, planning to reach stage of publication in December 2025. 21 participants have been enrolled in the protocol thus far, expecting to be finished with trials and recruitment by the end of 2024.

Keywords : major depressive disorder, gamma, neurostimulation, EEG

Conference Title : ICCPN 2025 : International Conference on Cognitive Psychology and Neuropsychology

Conference Location : London, United Kingdom

Conference Dates : April 10-11, 2025