Slow wave sleep decline has been linked to many pathologies, such as primary insomnia, Parkinson’s and Alzheimer’s disease. In recent decades non-invasive intervention methods have been shown to enhance slow wave sleep. One of these methods is closed loop acoustic stimulation (CLAS), during which acoustic stimuli are presented targeted at specific slow oscillation (SO) phases. The majority of CLAS research has been conducted in sleep labs using gold standard EEG equipment and for a limited amount of nights. Not a lot is known about the effects for CLAS in ambulatory environments and using EEG ambulatory equipment. Moreover, a lot remains unclear about the effects of CLAS in individuals with subjective sleep issues. In addition medium to long term effects from multiple nights of CLAS remain unclear. The current study will therefore investigate the effects of multiple nights of CLAS targeted at SOs using an ambulatory sleep monitoring headband (SMH; EEG, PPG, accelerometer and decibel sound pressure), in participants with subjective sleep issues and in their own homes. Two CLAS conditions will be compared, being acoustic stimulation, using subtle, non-arousing pink noise pulses targeted at the SO EEG up-waves during NREM stages 2 and 3, and silent (sham) stimulation targeted at the same up-waves. After two habituation nights to get used to wearing the SMH participants will experience five days of either sham or acoustic stimulation, followed by two break days, followed by five days of the remaining sham or acoustic stimulation condition (see figure below). SMH data and stimulus presentation markers will be recorded on a tablet computer and uploaded each morning using a secure cloud storage server (Research Drive), allowing for daily processing and analysis of the data. Both long- and short-term effects of CLAS will be compared, subjective sleep measures (using questionnaires) will be analyzed and sleep data will be processed and analyzed to determine if real-time and automated sleep stage scoring is feasible using SMH data using ambulatory equipment.

