# Stochastic cubic models of EEG dynamics during sleep-onset

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The sleep-onset period (SOP) exhibits dynamic and complex changes of Electroencephalogram (EEG) with high intra- and inter-individual variability (Lacaux, 2024). To investigate this, biophysical model of the ascending arousal system has been used to empirically explain the power spectrum changes during the SOP period (Yang, 2016), but not considering the changing rate of system parameter as well as non-negligible variance of input noise, in which the latter could cause jumping between bistable states and may play a role in narcolepsy and microsleeps (Roberts, 2017). Furthermore, validation by real EEG dataset is lacking. To tackle the limitations mentioned above, we firstly applied dimension reduction on EEG spectrogram to extract the dominant mode on wake and sleep states, in which the low-dimensional dynamics were modelled as output of stochastic parametric cubic (SPC) systems, to explain the dynamic changes of spectrum during transitional period. Also, we come up with a way to estimate the model parameter, which may be served as a biomarker to distinguish different subtypes of sleep-onset disorder.