Rotating pinwheel wave within biological master clock *Suprachiasmatic nucleus*

Byeongha Jeong[1], Jin Hee Hong[1], Kyungjin Kim[2], Kyoung J. Lee[1*]

[1]Department of Physics, Korea University, Seoul 136-713, Korea

[2]School of Biological Sciences, Seoul National University, Seoul 151-742, Korea

*E-mail: kyoung@korea.ac.kr

Within every clock cell that comprises the biological master clock, suprachiasmatic nucleus (SCN), several biochemical markers oscillate in a circadian fashion, and the oscillations propagate as a circadian phase wave over the whole clock cell population within the nucleus[1, 2]. However, little is known about their biophysical properties. Here, based on a realistic mathematical model [3, 4] as well as experiments with SCN slice cultures, we demonstrate that the wave can take any one of various modes, including phase-coherent oscillation, planar or oval-shaped wave, complex wave state with fragmented domains and most notably, a rotating pinwheel wave, which conceptually resembles a wall clock with a rotating hand. All of these are stable and the transitions among them can be induced by an extrinsic, spatially homogeneous, perturbation. Thus, no spatially-fixed circadian phase ordering seems to exist at least within an *ex vivo* SCN.

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