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1/f Fluctuations from amplitude modulation -diversity from Universe to stars and planets

Wednesday, July 19, 2023 10:00 AM (30 minutes)

1/f fluctuations abound in nature. From solid-state physics to nervous and biological systems, oceans, astrophysics, and Universe, there are very low-frequency signals whose time series power spectrum is f^α (-1.5<α<-0.5) for the frequency f. Since Johnson's first discovery of 1/f fluctuation in a vacuum tube experiment in 1925, the origin of it has been studied, but there has been no satisfactory solution so far.
In this talk, I will propose a model in which the many waves of accumulated frequencies generate 1/f fluctuation: amplitude modulation and demodulation. The possible mechanisms for spontaneously creating these coherent waves are a) synchronization, b) resonance, and c) infrared divergence. In this talk, I will describe corresponding astrophysics and find the common physics behind them.
a) Synchronization: Synchronization of the solar magnetic field in the macrospin model and coupled local heat engines of variable stars.
b) Resonance: seismic activities, Earth rotation axes wobble, and Earth-free oscillation.
c) Infrared divergence: the origin of the density fluctuations in the early Universe, current fluctuations in semiconductors, and 1/f fluctuations in living organisms due to neural firing.
I will talk about these topics with many numerical calculations.
Reference: https://doi.org/10.1038/s41598-023-34816-2

Is this abstract from experiment?

No

Name of experiment and experimental site

N/A

Is the speaker for that presentation defined?

Yes

Details

Prof. Masahiro Morikawa, Ochanomizu University, Japan,
https://www.ocha.ac.jp/en/

Internet talk

No

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