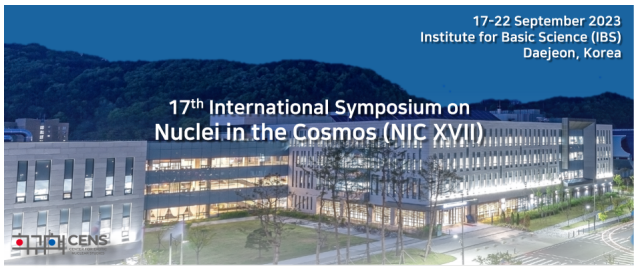

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Multi-messenger Signals of Heavy Axionlike Particles in Core-collapse Supernovae

Tuesday, 19 September 2023 17:10 (5 minutes)

Axion-like particles (ALPs) are a class of hypothetical pseudoscalar particles which feebly interact with ordinary matter. The hot plasma in core-collapse supernovae is a possible laboratory to explore physics beyond the standard model including ALPs. Once produced in a supernova, a part of the ALPs can be absorbed by the supernova matter and affect energy transfer. We recently developed two-dimensional supernova models including the effects of the production and the absorption of ALPs that couple with photons. It is found that the additional heating induced by ALPs can enhance the explosion energy; for moderate ALP-photon coupling, we find explosion energies ~0.6*10^51 erg compared to our reference model without ALPs of ~0.4*10^51 erg. Our findings also indicate that when the coupling constant is sufficiently high, the neutrino luminosities and mean energies are decreased because of the additional cooling of the proto-neutron star. The gravitational wave strain is also reduced because the mass accretion on the proto-neutron star is suppressed.

Primary author: MORI, Kanji (National Astronomical Observatory of Japan)

Co-authors: Prof. TAKIWAKI, Tomoya (National Astronomical Observatory of Japan); HORIUCHI, Shunsaku (Virginia Tech); Prof. KOTAKE, Kei (Fukuoka University)

Presenter: MORI, Kanji (National Astronomical Observatory of Japan)

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