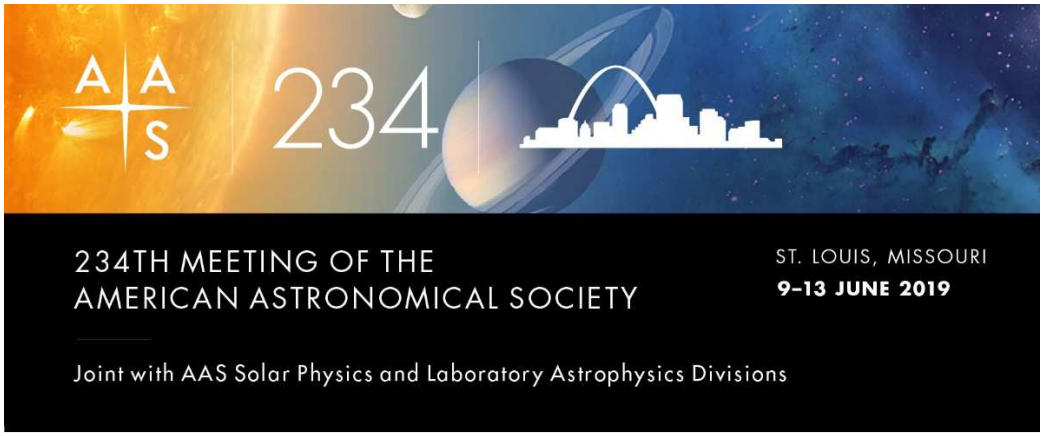

Abstract

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TITLE: First Principles of Linger-Thermo Theory, a Time-Complementary Duality in Physics, Inherently Lead to Average Mass of Star Particles and Organism Cells

Abstract (2,250 Maximum Characters): Linger-thermo theory (LTT) is part of a time-complementary past-uncertainty/future-certainty spacetime duality in physics with uncertainty initial state that yields maximally efficient and affordable solutions such as in radar **(Feria, 2014 SPIE Newsroom article 10.1117/2.1201407.005429 & 2018 US Patent 10,101,445)**. LTT has been used in astrobiology **(Feria, AAS 49 PS)** and dark-matter studies via thermotes **(Feria, AAS 230).** Thermotes surfaced in LTT in 2014 from the derivation of the entropy of flexible-phase mediums for use in lifespan studies. They simplify entropy finding and their energy is $e_{Th}=N_{DoF}k_BT/2$ where k_B is the Boltzmann constant, T is the temperature of the medium and N_{DoF} is the number of degrees of freedom (DoF) for a particle, e.g., 3 for photon-gas (PG) photons and 2 for black-hole (BH) particles in its event horizon. For the BH and PG their entropy is $k_B/2$ times the ratio of their mass-energy over the thermote energy, which then via the 2nd law of thermodynamics leads to the LTT conjecture that T decreases with time with the thermote energy loss fueling the Universe's expansion. Moreover, the eV mass of the BH and PG thermotes at the cosmic microwave background (CMB) temperature of 2.725 Kelvin is found to be 235.14 μeV and 352.71 μeV, respectively, values which fall within the 50 to 1,500 μeV range for the axion, a top dark matter candidate **(Borsanyi, et al. 2016, Nature).** In LTT the shape of the medium of mass M and volume V is modeled as a sphere of radius r where at its center its point-mass resides. In this LTT model there are M/m_G gyrador particles whose total kinetic energy matches the gravitational potential energy $GM^2/2r$ of the medium. Each gyrador of mass m_G orbits a quantum of operation (QoO) mass $\triangle M$ at the center of a sphere of radius $\triangle r$ with orbiting-speed $v=(G\triangle M/\triangle r)^{1/2}$ and $\triangle M/\triangle r=M/r$. In LTT the kinetic energy $m_Gv^2/2$ of the gyrador is set equal to the thermote energy e_{Th} which then yields $m_G=2re_{Th}/GM$ whose evaluation for the sun and humans matches the average mass of sun particles and human cells.