



University of Crete  
Department of Physics



**FORTH**  
INSTITUTE OF ASTROPHYSICS



## *Joint Physics & IA/FORTH Colloquium*

Thursday, 16 February 2023 | 17:00 – 18:00, Seminar Room 3<sup>rd</sup> Floor

### **New Physics in the Cosmos**

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#### **ABSTRACT**

*The standard model of particle physics holds – at energies as high as we have managed to achieve in terrestrial accelerators. Yet, astrophysical probes of the most extreme systems hint – not subtly at all – towards new Physics: the matter density of the Universe appears dominated by some unknown non-baryonic substance (dark matter); the energy density of the Universe appears to be dominated by some field of unknown nature, acting anti-gravitationally (dark energy); the geometry and seed fluctuations of the Universe appear to have been set by the early action of yet another unknown field (inflaton); and the development of atmospheric air showers caused by collisions with our atmosphere of the highest-energy particles in the Universe (extragalactic ultra-high-energy cosmic rays) continues to defy our understanding. I will discuss how the Cosmos may prove to be this century's new Physics laboratory, focusing on two novel paths towards extracting information about new Physics from extreme Astrophysics. The first is electromagnetic probes of ultra-high-energy cosmic-ray composition, which will allow the use of atmospheric air showers as nature's accelerators at center-of-mass energies an order of magnitude higher than the LHC. The second is the properties of galaxy clusters on their largest non-expanding scales, which uniquely, directly, and locally probe the magnitude and nature of dark energy.*