LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN | ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

Sommerfeld Theory Colloquium

Wednesday, 19th January 2022
at 16.15 h

Prof. Günther Hasinger
(ESA Director of Science)

Is Dark Matter made of Primordial Black Holes? JWST might tell!

We explore the observational implications of a model in which primordial black holes (PBHs) with a broad birth mass function ranging in mass from a fraction of a solar mass to ~10^6 $M_\odot$, consistent with current observational limits, constitute the dark matter component in the Universe. The formation and evolution of dark matter and baryonic matter in this PBH-ΛCDM Universe are presented. In this picture, PBH DM mini-halos collapse earlier than in standard ΛCDM, baryons cool to form stars at z~15–20, and growing PBHs at these early epochs start to accrete through Bondi capture. The volume emissivity of these sources peaks at z~20 and rapidly fades at lower redshifts. As a consequence, PBH DM could also provide a channel to make early black hole seeds and naturally account for the origin of an underlying dark matter halo - host galaxy and central black hole connection that manifests as the M_{bh}–σ correlation. To estimate the luminosity function and contribution to the integrated emission power spectrum from these high-redshift PBH DM halos, we develop a Halo Occupation Distribution (HOD) model. In addition to tracing the star formation and reionizaton history, it permits us to evaluate the Cosmic Infrared and X-ray Backgrounds (CIB and CXB). We find that accretion onto PBHs/AGN successfully accounts for the detected backgrounds and their cross-correlation, with the inclusion of an additional IR stellar emission component. Detection of the deep IR source count distribution by the JWST could reveal the existence of this population of high-redshift star-forming and accreting PBH DM.

A348, Theresienstr. 37, and via ZOOM

Slava Mukhanov