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THESEUS: a future key mission for multi-messenger astrophysics

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The Transient High-Energy Sky and Early Universe Surveyor (THESEUS) is a space mission concept aimed at exploiting Gamma-Ray Bursts for investigating the early Universe and at providing a substantial advancement of multi-messenger and time-domain astrophysics. These goals will be achieved through a unique combination of instruments allowing GRBs and X-ray transients detection over a broad FOV (more than 1sr) with 0.5-1 arcmin localization, an energy band extending from several MeVs down to 0.3 keV and high sensitivity to transient sources in the soft X-ray domain, as well as on-board prompt (few minutes) follow-up with a 0.7 m class IR telescope with both imaging and spectroscopic capabilities. In addition to early Universe science, THESEUS will be perfectly suited for the detection, accurate localization and identification of the electromagnetic counterparts to sources of gravitational radiation, which will be routinely detected in the late '20s / early '30s by next generation facilities like aLIGO/ aVirgo, ILIGO, KAGRA, eLISA and Einstein Telescope. In particular, it will be able to detect and localize with an accuracy of ~a few arcmin short GRBs produced by NS-NS or NS-BH mergers and provide their redshift, as well as detect, localize and characterize the associated NIR kilonova emission and the possible soft X-ray. THESEUS will thus provide an ideal sinergy with second and third generation GW detectors and with the large multi-wavelength observatories of the near future (e.g., LSST, ELT, SKA, CTA, ATHENA).

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