## Thesis abstract Lucas Gréaux

## « Gamma-ray cosmology – Conclusions from three decades of extragalactic gamma-ray astronomy and perspectives for CTAO »

Hundreds of extragalactic gamma-ray sources have been detected at energies ranging from GeV to TeV by Fermi-LAT and atmospheric Cherenkov imaging telescopes (IACTs). In 2012, these extragalactic gamma-ray beacons enabled the measurement of the brightest diffuse photon field in the universe, arising from the thermal emission of galaxies: the extragalactic background light (EBL). The EBL, which traces the cumulative history of star formation since the onset of reionization, acts as a target photon field for gamma rays, thanks to the production of electron-positron pairs. Gamma-ray cosmology, the field that studies this interaction, allows not only to probe the EBL, but also to constrain cosmological parameters. In this thesis, we present the synthesis of three decades of extragalactic gamma-ray astronomy at very high energies (VHE, above 100 GeV): the STeVECat catalog. To date, STeVECat is the most comprehensive catalog of extragalactic observations for the current generation of IACTs, H.E.S.S., MAGIC and VERITAS. This view of the gamma-ray sky has allowed the study of the median spectral state of different blazars, despite their observed rapid variability. We present a new analysis framework for gamma-ray cosmology based on Bayesian inference methods, that accounts for possible biases in the modeling and spectral reconstruction of different observations. Applied to the STeVECat data, this framework has led to the first measurement of the EBL using only gamma-ray observations, independently of reference models. These results are in agreement with EBL measurements derived from galaxy counts in deep-field surveys and the most recent direct measurement of EBL by the New Horizons probe. This work allows us to constrain the emission of diffuse source populations in the universe, as well as the value of the Hubble constant. We demonstrate the potential of the next generation of IACTs for gamma-ray cosmology measurements. In the coming years, the Cherenkov Telescope Array (CTAO) will provide an unprecedented view of the non-thermal universe, ushering in the era of precision for gamma-ray cosmology.