In this thesis, we present our two studies focused on the detection of cosmic γ–rays and the analysis of data from γ–ray observations. One study deals with the method of the Cherenkov transparency coefficient. This method is suitable for the detector calibration in experiments employing imaging atmospheric Cherenkov telescopes for the indirect detection of cosmic γ–rays. Using rates of recorded air showers initiated by charged cosmic rays, the method aims at the monitoring of the atmospheric transparency to Cherenkov light and the calibration of the responses of Cherenkov telescopes. We present an extension of this method for the purposes of the Cherenkov Telescope Array observatory and demonstrate its feasibility using Monte Carlo simulations. Our other analysis utilizes more than 7 years of data from direct γ–ray observations by the Fermi Large Area Telescope. We describe in detail signal observed from the parts of the sky around the active galactic nuclei 1ES 0229+200 and Centaurus A. We report on the findings of new astrophysical sources of high energy photons and document spectral and temporal properties of their γ–ray fluxes.