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Advanced stream search for galaxy clusters with multifrequency microwave data

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Abstract

© The Authors, published by EDP Sciences, 2018. Based on the data from the Westerbork Northern Sky Survey performed at a frequency of 325 MHz in the range of right ascensions 0h 2h and declinations 29o 78o and using multifrequency Planck maps, we selected candidate objects with the Sunyaev-Zeldovich effect. The list of the most probable candidates includes 381 sources. It is shown that the search for such objects can be accelerated by using a priori data on the negative level of fluctuations in the CMB map with remote low multipoles in the direction to radio sources existence to our days. The study of galaxy clusters observed due to the Sunyaev-Zeldovich effect [5] in the millimeter and submillimeter ranges and also in the X-ray range in which hot gas radiation is observed and simply in the visible range remains one of top directions in cosmological studies. These studies allow us to trace the evolution of masses of clusters and the features of formation of a large-scale structure of the Universe in various cosmological epochs. Significant extension of the list of galaxy clusters in the millimeter range is associated with the appearance of multi-frequency measurements of the microwave radiation such as Planck [6], SPT [7], and ACT [8] experiments. First data from the Planck observatory showed that the documented amount of galaxy clusters (about 1.6 thousand) observed with the help of the SZ-effect, is significantly (by 2 orders) smaller than expected from the data of optical surveys and modeling. Some selection effects can influence the detection of galaxy clusters with the SZ-mechanism. These are: the difficult-to-remove background emission of our Galaxy, point radiation sources, whose contribution to the microwave background covers the depth of the SZ-effect, and the dependence of the radiation amplitude determined by this effect on the mass of clusters which can have a relatively large scatter. It is also important to notice that radio sources are also used to study the distant Universe [9-11]. Due to the set of their physical properties, radio sources are a powerful tool for testing cosmological epochs. They are associated with searching for the most distant active nuclei of galaxies [12, 13], for protoclusters [14], estimating the background object clustering at different redshifts [15], and investigating the gravitational lensing. Taking into account the possibilities of millimeter and submillimeter surveys, the problem of searching for galaxy clusters with radio sources both at small and great redshifts naturally arises with the help of the Sunyaev-Zeldovich effect. In this paper, we check the possibility of detecting the SZ-effect in the vicinity of radio sources from low-frequency WENSS survey [16] using multifrequency microwave maps of the Planck space mission [17]. This work follows our previous paper [18].

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