Interstellar neutral atoms of helium from the local interstellar medium are observed by the Interstellar Boundary Explorer (IBEX) spacecraft in the Earth orbit. Researchers from CBK PAN, together with international collaborators, analyze these observations to determine the Sun's motion with respect to the local interstellar medium and the temperature of this medium. In a broader perspective, results of these analyses provide important insight into mechanisms of interaction of the heliosphere with its surroundings. In a paper recently published in *The Astrophysical Journal* they analyzed data from two energy channels of the IBEX-Lo detector previously not used, in addition to the data from the channel used beforehand, and obtained a better assessment of these quantities.

One of the main goals of the IBEX mission is investigating the neutral interstellar matter around the Sun. The neutral component of the local interstellar medium penetrates into the heliosphere, unlike the ionized components, which are bound by electromagnetic forces to the electromagnetic fields of a complex structure around the heliosphere. Some of the atoms of the interstellar neutral gas that have entered the heliosphere are ionized by the solar wind or solar EUV radiation and are carried away, but a portion of them penetrates sufficiently close to the Sun to be measured by a detector located close to Earth.

The structure of the interstellar medium at scales of tens and hundreds of parsecs around the Sun is not homogeneous. The Sun is within a system of multiple partially ionized, warm (5000-8000 K) and dense (~0.2 cm^{-3}) clouds, embedded in a very hot (~10^6 K), completely ionized and rarefied (~0.005 cm^{-3}) region. Telescopic observations of the absorption lines towards the closest stars show that the Sun is located in one of two clouds known as the Local Interstellar Cloud and G Cloud, or – more likely – in a boundary region between them. However, the ultimate determination is not possible from the telescopic observations. Results of the IBEX mission may allow to resolve this enigma and answer the question how the condition in the interstellar medium along the Sun's path will be changing during the forthcoming millennia.

Previously, only data from one of the energy channels of the IBEX-Lo detector had been used in the analysis of the local interstellar gas. This was due to limited knowledge of the sensitivity of the detector to the atoms incoming with various velocities (i.e., with various kinetic energies). As a first approximation, the energy channel that had been used in the previous analyses was assumed to have a sensitivity independent of the atom energy. In this study, scientists from CBK PAN analyzed observations from the three energy channels of the IBEX-Lo detector in which interstellar neutral helium is visible and abandoned the assumption of the uniform energy

sensitivity. The analysis aimed at determining the temperature and velocity vector of interstellar neutral helium simultaneously with the determination of the velocity-dependent sensitivity. They found that the previously found parameters of the interstellar medium do not need revision. This is important because this analysis lends more credence to the previous analyses of interstellar neutral gas and its secondary component , the so-called Warm Breeze, and to conclusions stemming from these analyses concerning the orientation of the interstellar magnetic field.

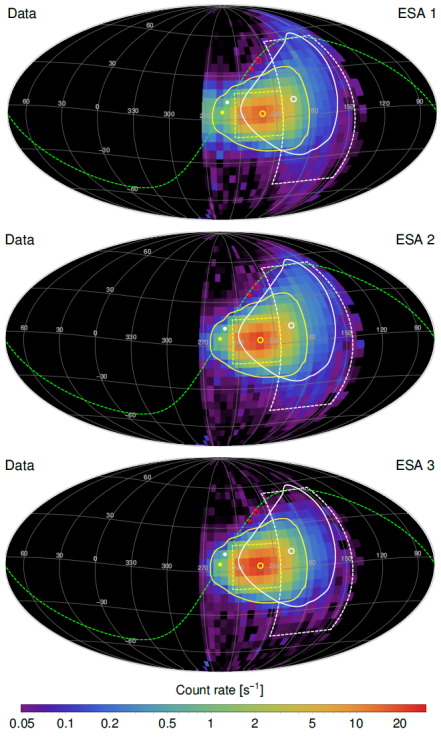

Figure: Sky maps of the count rates due to interstellar neutral atoms observed by IBEX in the analyzed energy channels. The maps are centered at the direction of the Sun's motion with respect to the interstellar medium. The atoms are deflected by the Sun's gravity and thus observed away from this direction. The differences between energy channels are caused by a contribution of hydrogen atoms (not considered in this analysis) and the different energy-dependent sensitivity of the IBEX-Lo detector.