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Inflow Direction of Interstellar Neutrals deduced from Pickup Ion Measurements at 1 AU

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The, so called, interstellar pickup ions are born from ionization of the interstellar neutral background gas by solar UV radiation or charge exchange with solar wind protons. The low speed of these interstellar particles in respect to the solar wind, forces them - after ionization - on circular orbits around the magnetic field, which is embedded into the solar wind. As a result, interstellar pickup ions show very characteristic velocity spectra with a sharp cut-off at $2{\cdot}v_{SW}$, once they have been picked up by the solar wind. Furthermore, the influence by the Sun's gravitational force and UV radiation results in a very characteristic angular distribution in the eclitpic plane featuring two distinct structures, that are both believed to be aligned along the inflow direction of interstellar matter.

Here we present recent observations of interstellar pickup ions with the Plasma and Suprathermal Ion Composition instrument (PLASTIC) mounted on the Solar TErrestrial RElations Observatory A (STEREO A). PLASTIC is a time-of-flight mass spectrometer, that determines the velocity, mass and charge of incoming ions by measuring their energy-per-charge, total energy and time-of-flight. STEREO PLASTIC's big geometric factor and the unusual prolonged solar minimum allows for the first time investigation of heavy pickup ions with unprecedented quality. Within the framework of our analysis we have performed a superposed epoch analysis of four consecutive STEREO A orbits that allowed us to reveal in-situ the angular distribution of He^+ as well as heavy pickup ions (O^+ and Ne^+) at 1 AU. By analysing the interstellar features, namely the interstellar focusing cone and crescent, of the He^+, O^+ and Ne^+ signature, we were able to estimate the inflow direction of interstellar helium as well as interstellar oxygen and neon. Our measurments revealed an inflow direction of $\lambda_{\mathrm{He}^+} = 77.37°$, $\lambda_{\mathrm{O}^+} = 78.42°$, and $\lambda_{\mathrm{Ne}^+} = 77.44°$, which deviates from previously published results, deduced from the position of the He^+ focusing cone, by around $2°$.