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The structure of the heliosphere revisited: jets driven by the sun

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The classic accepted view of the heliosphere is a quiescent, comet-like shape aligned in the direction of the Suns travel through the interstellar medium (ISM) extending for 1000s of AUs . Here we show, based on magnetohydrodynamic (MHD) simulations, that the twisted magnetic field of the sun confines the solar wind plasma and drives jets to the North and South very much like astrophysical jets. These jets are deflected into the tail region by the motion of the Sun through the interstellar medium similar to bent galactic jets moving through the intergalactic medium. The interstellar wind blows the two jets into the tail but is not strong enough to force the lobes into a single cometary-like tail. Instead, the interstellar wind flows around the heliosphere and into equatorial region between the two lobes. Here we show that the heliospheric jets are turbulent (due to large-scale MHD instabilities and reconnection) and strongly mix the solar wind with the ISM beyond 400AU. The resulting large-scale MHD turbulence will have important implications for particle acceleration in the heliosphere. The two-lobe structure is consistent with the energetic neutral atoms (ENAs) images in the tail from IBEX where two lobes are produced in the North and South.