

The New Heliosphere

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The sun's solar wind carves a bubble in the interstellar medium, called the heliosphere. The recent measurements in-situ by the Voyager spacecrafts, combined with the all-sky images of the heliospheric boundaries by the Interstellar Boundary Explorer (IBEX) mission have transformed our understanding of the heliosphere. Concepts that resisted decades are being revisited due to their puzzling measurements. In particular one of the first surprises was that both Voyager found no evidence for the acceleration of the anomalous cosmic rays at the Termination Shock as expected for approximately 25 years. Another challenge are the energetically particles intensities that are dramatically different at Voyager 1 and 2. More recently, observations of Voyager 1 indicate that the spacecraft is magnetically connected to the interstellar medium while being inside the heliosheath. In this talk I will review the state-of-the art of our understanding of this "new heliosphere" as well as the future challenges. In particular I will focus on our recent suggestion that reconnection between the solar magnetic field and the interstellar magnetic field explains the dramatic dropouts and then the disappearance of the solar energetic particles. I will review as well our recent model that propose that reconnection is happening in the heliosheath within the sector region and its consequences for the nature of the heliosheath, affecting both the flows and transport of energetic particles.