PHYSICS OF THE OUTER HELIOSPHERE

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The solar wind in the outer heliosphere is fundamentally different from that in the inner heliosphere, since the influence of the local interstellar source becomes significant. We presented a multi-fluid MHD model, which takes into account the effects of pickup ions, to describe the solar wind in the outer heliosphere. Using observations from multiple spacecraft distributed throughout the heliosphere, we traced the propagation of ICMEs and their driven shocks from 1 AU to the location of Voyager 2. On October 16, 2001, Voyager 2 at 65 AU observed a strong shock with a speed jump over 100 km/3, the strongest shock recorded since 1991, but no single solar event was directly responsible for this shock. Instead, a series of solar events in April 2001 was responsible. The model results show that successive merging and interaction of relatively small interplanetary shocks could form a well-developed strong forward shock beyond 30 AU. In August 2007, Voyager 2 reached the termination shock and entered the heliosheath at a distance of about 84 AU. Due to the variations of the solar wind dynamic pressure or waves on the shock front, the termination shock crossed Voyager 2 multiple times. We examined the characteristics of the termination shock in detail. For two crossing events, the flow is found to be still supersonic with respect to the thermal ions downstream of the termination shock, probably due to the fact that most of the solar wind energy is transferred to pickup ions.

Heliosphere, Solar Wind, MHD modeling

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