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# Potential Role of Mirror and Ion Bernstein Instabilities on scattering of Pickup Ions in the Outer Heliosheath

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A dominant feature in all-sky maps of energetic neutral atoms (ENAs) from NASA's Interstellar Boundary EXplorer (IBEX), which propagate to Earth from the outer heliosphere and the local interstellar medium (LISM), is a ribbon of enhanced fluxes. Among a dozen models proposed, consensus has gathered around a so-called secondary ENA source for the ribbon. In this mechanism, maintaining the stability of pickup ions before the final charge-exchange is a critical element, because the charge-exchange period in that environment is much longer than pitch-angle scattering by large-scale turbulence prevalent in interstellar space and small-scale local turbulence due to kinetic instabilities. As for the latter, a recent study showed that a pickup ion ring can remain stable to the Alfvén/ion cyclotron (AC) instability at propagation parallel to the background magnetic field when the parallel thermal spread of the ring is comparable to that of the background population, allowing for pickup ions to remain stable. On the other hand, it has been suggested that the pickup ion ring can also drive the mirror and ion Bernstein (IB) instabilities not considered previously. The motivation for this study is to investigate the potential role that these oblique instabilities can play in the stability of pickup ions when conditions are such that the AC instability is suppressed. Results of theoretical analysis and hybrid (kinetic ions/massless fluid electrons) simulations show that such oblique modes not considered previously do grow and in the above situation, can be a dominant pitch-angle scattering agent. Meanwhile, these modes are relatively short-lived, thereby still leaving room for the needed stability as far as interactions with self-generated waves are concerned.

References

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