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Possible Role of Fluctuation Excitation in the Formation of Alfvénic Fluctuations Originating from Interchange Magnetic Reconnection

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Parker Solar Probe has detected abundant magnetic inversions and velocity spikes in the young solar wind, the origins of which are still highly debated. Numerous studies based on observational data and numerical simulations favor the causal correlation between interchange magnetic reconnection process and these velocity spikes. However, the specific process by which interchange magnetic reconnection leads to these structures is still inconclusive. Interchange reconnection should occur during the eruption of small bipoles in pre-existing open magnetic field regions such as coronal holes. This process is known to drive the formation of plumes and pseudo-streamer like structures and potentially mesoscale structures measured in the solar wind as well as velocity spikes. Using velocity measurements from Solar Orbiter we infer the magnetic origin of mesoscale structures and velocity spikes measured by Solar Orbiter, we find that the footpoints of the magnetic lines associated with these spikes are located at the boundary of a coronal hole observed by the Solar Dynamics Observatory (SDO), where the interchange magnetic reconnection is likely to occur. The imaging instruments aboard Solar Orbiter and SDO record one typical interchange magnetic reconnection event near the footpoints. With the high temporal/spatial resolution images obtained from multiple perspectives, we directly analyze the fluctuating motion of jet flow materials and explore the mechanism of fluctuation excitation during the interchange magnetic reconnection. We compare our observations with a 2.5D MHD simulation of interchange magnetic reconnection, we speculate that outward fluctuations may act as a kind of mediator between interchange magnetic reconnection and the formation process of velocity spikes/magnetic switchbacks.