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Deciphering the Nanojet Phenomenon

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The solar corona is shaped and mysteriously heated to millions of degrees by the Sun's magnetic field. It has long been hypothesised that the heating results from a myriad of tiny magnetic energy outbursts called nanoflares, driven by the fundamental process of magnetic reconnection. This theory recently received significant support through the observational discovery of nanojets - very fast (>100 km/s) and bursty (<20 s) jet-like structures with energies in the nanoflare range, uniquely characterised by being transverse to the loop and, in most cases unidirectional from the reconnection point. We have interpreted the nanojet as the telltale sign of small-angle reconnection leading to nanoflares. It can occur isolated or clustered, with large ensembles showing signatures of an MHD avalanche-like progression, leading to the formation of hot coronal loops. We have since observed nanojets in various structures in which dynamic instabilities such as Kelvin-Helmholtz play a role. Using state-of-the-art numerical simulations, we demonstrate that the nanojet is a consequence of the slingshot effect from the magnetically tensed, braided or curved magnetic field lines reconnecting at small angles. We further show that Alfvén waves can play a binding effect as reconnection triggers. This talk will discuss the open questions related to nanojets and their potential role in coronal heating. We show how next-generation instrumentation, such as MUSE and state-of-the-art simulations, can help elucidate this fascinating phenomenon.

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