

# Differentiating the Acceleration Mechanisms in the Slow and Alfvénic Slow Solar Wind

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In the corona, plasma is accelerated to hundreds of kilometers per second and heated to temperatures hundreds of times hotter than the Sun’s surface before it escapes to form the solar wind. Decades of space-based experiments have shown that the energization process does not stop after it escapes. Instead, the solar wind continues to accelerate, and it cools far more slowly than a freely expanding adiabatic gas. Recent work suggests that fast solar wind requires additional momentum beyond what can be provided by the observed thermal pressure gradients alone, whereas it is sufficient for the slowest wind. The additional acceleration for fast wind can be provided through an Alfvén wave pressure gradient. Beyond this fast/slow categorization, however, a subset of slow solar wind exhibits high Alfvénicity that suggests that Alfvén waves could play a larger role in its acceleration compared to conventional slow wind outflows. Through a well-timed conjunction between Solar Orbiter and Parker Solar Probe (PSP), we trace the energetics of slow wind to compare with a neighboring Alfvénic slow solar wind stream. An analysis that integrates remote and heliospheric properties and modeling of the two distinct solar wind streams finds that Alfvénic slow solar wind behaves like fast wind, where a wave pressure gradient is required to reconcile its full acceleration, while non-Alfvénic slow wind can be driven by its nonadiabatic electron and proton thermal pressure gradients. Derived coronal conditions of the source region indicate good model compatibility, but extended coronal observations are required to effectively trace solar wind energetics below PSP’s orbit.