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Effects of Heating Inside and Outside the Compound Sonic Point of the Solar Wind

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We revisit the problem of the effect of heat addition in the solar wind including Alfven wave pressure as well as the plasma pressure (proton plus electron pressure). It is well known that the mass flux per unit area in 1D gas flow maximizes when the flow speed equals the sound speed. This result also holds in the presence of Alfven waves, in which the wave energy exchange equation yields the wave action flux conservation law when their contribution to the compound sound speed is taken into account. The analysis proceeds along the lines of calculating the changes induced in a steady flow along a tube (Laval nozzle) by the addition of small amounts of heat and momentum, using a thin slice approximation which leads to Rankine-Hugoniot type relations for weak deflagrations or detonations. The effective polytropic index γ and flow speed relative to the compound flow speed ahead of the slice play crucial roles in determining whether local acceleration or deceleration results. Some results are at first sight unexpected since $\gamma$for Alfven waves ranges from -1/2 (in sub-Alfvenic flow) to 3/2 in super-Alfvenic flow.