EVOLUTION OF ALFVÉN WAVE-DRIVEN SOLAR WINDS TO RED GIANTS

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By performing global 1D MHD simulations with radiative cooling and thermal conduction from the photosphere to 30-60 stellar radii, we investigate the heating and acceleration of solar and stellar winds.

First, we show the result of the coronal heating and the solar wind acceleration in the open magnetic field regions. We impose transverse photospheric motions with velocity $\langle dv_\perp \rangle \approx 1$km/s and period between 20 seconds and 30 minutes, which generate outgoing Alfvén waves. We have found that the dissipation of Alfvén waves through compressive wave generation by decay instability is quite effective owing to the density stratification, which leads to the sufficient heating and acceleration of the coronal plasma (Suzuki & Inutsuka 2005, ApJL, 632, L49; 2006, JGR, 111, A06101).

Next, we study the evolution of stellar winds from main sequence to red giant phases. When the stellar radius becomes ≈ 10 times of the Sun,

the steady hot corona with temperature, $T \approx 10^6$ K, suddenly disappears. Instead, many hot and warm ($10^5 - 10^6$ K) bubbles are formed in cool ($T \leq 2 \times 10^4$ K) chromospheric winds because of the thermal instability of the radiative cooling function; the red giant wind is not a steady stream but structured outflow. Also, the wind velocity is much smaller than the surface escape speed, because the wind starts to be accelerated from several stellar radii (Suzuki 2007, ApJ, 659, 1592).