



Heating the Solar Wind

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Parker showed that the mystery of the existence of a supersonic solar wind could be solved if only a suitable source of heat could be found in the corona. The Sun possesses many different energy reservoirs that are sufficient to provide the acceleration of the solar wind if only they could be coupled to the plasma. Many suggestions have been made for this coupling: shock waves, Alfvén waves, reconnection and ion cyclotron waves but we do not know if any of these mechanisms provides sufficient energy to the plasma in the region of observed acceleration. In situ measurements in the inner corona are needed to resolve this mystery, but, while long advocated, have not been forthcoming. Our only resource is to interpret the clues that the solar wind gives us. One of these is the occurrence of mirror mode waves in the solar wind. Their radial variation points to the corona as the source of the waves. This is a critical piece of knowledge because these waves are generated by velocity-space anisotropies such as ring beams that also generate ion-cyclotron waves. While mirror mode waves are long lasting structures that interact little with their environment, ion-cyclotron waves damp and heat the plasma. Hence the mirror mode waves may be messengers telling us that ion-cyclotron waves are being created and damped in the corona. This in time can give us clues to the heating mechanics as it must create a strong velocity-space anisotropy, possibly a ring beam. In short we need further observational and theoretical study of mirror mode waves in the solar wind.