

# ENHANCED PHASE MIXING OF ALFVEN WAVES IN STRATIFIED AND DIVERGENT CORONAL STRUCTURES

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We explore the solar coronal heating enigma by an analytical and numerical study of the enhanced phase mixing of harmonic Alfvén waves propagating in gravitationally stratified coronal structures of varying magnetic field divergence. We derived corrected analytical solutions describing the enhanced phase mixing of Alfvén waves in weakly divergent stratified coronal structures. These new analytical solutions show that the enhanced phase mixing mechanism can dissipate Alfvén waves at heights less than half that predicted by the previous analytical solutions of Ruderman, Nakariakov and Roberts (1998). Improved analytical solutions that accurately describe the enhanced phase mixing of Alfvén waves in strongly divergent stratified coronal structures are also presented. In divergent and stratified coronal structures, enhanced phase mixing occurs only when the ratio of the magnetic and density scale heights,  $H_b/H_\rho < 2$ . The enhanced phase mixing of 0.1 Hz harmonic Alfvén waves propagating in strongly divergent,  $H_b = 5$  Mm, stratified coronal structures,  $H_\rho = 50$  Mm, can generate viscous heating rates of  $10^{-4} \text{ J m}^{-3} \text{ s}^{-1}$  or 100 % of an active regions heating requirement, compared to  $\approx 10$  % in an uniform magnetic field. They are also fully dissipated within 20 Mm or six times lower than would occur as a result of standard phase mixing in uniform magnetic fields and is less than half the density scale height. This study shows that the importance of enhanced phase mixing as a mechanism for dissipating Alfvén waves in the solar corona, a stratified and divergent medium, has been seriously underestimated.