Cross-field superslow propagation by phase-mixing of Alfven/slow mode waves in solar corona

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We discuss the apparent cross-field propagation by phase mixing of continuum Alfven waves or continuum slow mode waves in the solar coronal magnetic structures.
Recent observations and numerical simulations for coronal waves have found waves propagating across magnetic field lines at rather slow speed. Although only fast mode waves can propagate across magnetic field lines, the observed propagation speed is much slower than the typical fast mode speed. Hence it has been difficult to understand the nature of this cross-field ‘superslow’ propagation. We show that the phase-mixing of continuum Alfven or slow mode waves can explain this phenomenon. Phase-mixing of continuum Alfven or slow mode waves produces phase velocities perpendicular to magnetic field that decrease with time. Hence phase mixing can produce a cross-field superslow propagation after a sufficient lapse of time. We show that the analytical solutions of apparent wavelength and phase speed of phase-mixing quantitatively explain the superslow waves in the results of numerical simulation. We also show the existence of superslow waves in coronal potential arcades and discuss the applicability of our results to coronal seismology.

Keywords: Solar corona, Solar prominence/filament, MHD wavess

