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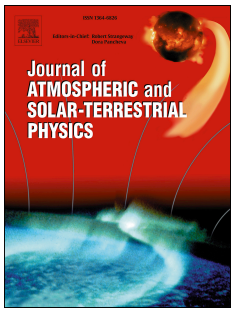

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Sausage oscillations in a plasma cylinder with a surface current

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Abstract

Linear sausage oscillations of a cylinder embedded in a plasma with an azimuthal magnetic field, created by a current on the surface of the cylinder, are studied. Such a plasma configuration could be applied to modelling flaring loops, and magnetic ropes in coronal mass ejections. The plasma is assumed to be cold everywhere. Dispersion relations demonstrate that the lowest radial harmonic of the sausage mode is in the trapped regime for all values of the parallel wave number. In the long-wavelength limit, phase and group speeds of this mode are equal to the Alfvén speed in the external medium. It makes the oscillation period to be determined by the ratio of the parallel wavelength, e.g. double the length of an oscillating loop, to the external Alfvén speed, allowing for its seismological estimations. The application of the results obtained to the interpretation of long-period (longer than a minute) oscillations of emission intensity detected in solar coronal structures, gives reasonable estimations of the external Alfvén speed. Cutoff values of the parallel wavenumber for higher radial harmonics are determined analytically. Implications of this finding to the observational signatures of fast magnetoacoustic wave trains guided by cylindrical plasma non-uniformities are discussed.

Keywords: oscillations, corona

1. Introduction

Oscillatory processes in plasma non-uniformities of the solar corona have been intensively studied observationally for about two decades (e.g., see De Moortel and Nakariakov, 2012; Liu and Ofman, 2014, for recent comprehensive reviews), mainly in the context of solar coronal plasma heating and wave-based diagnostics of the coronal plasma, magnetohydrodynamic (MHD) seismology. The main feature of the solar corona that prescribes MHD wave dynamics, and

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