"ACOUSTIC WAVES GENERATED BY IMPULSIVE DISTURBANCES IN A GRAVITATIONALLY STRATIFIED MEDIUM"
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There are two well-known oscillations detected from the sun: the five-minute oscillation period attributed to global pressure modes (or "p-modes") in the solar interior, and the lesser-known three-minute oscillations in the chromosphere. Like the interior p-modes, the chromospheric oscillations are thought to be standing oscillations, waves that are trapped between two nodes from which they reflect. In this case, the photosphere and the transition region (TR) between the chromosphere and corona would be such reflecting nodes. However, signatures of these oscillations have been detected in the low corona, indicating that they are able to propagate through the TR. In this study, the authors investigate an alternative explanation to the idea that the cutoff frequency at the temperature minimum can explain the three-minutes oscillations, since it doesn't explain why frequencies just above the cutoff are largely evanescent. They suggest that the medium through which the waves are travelling manifests its response to some type of excitation in the form of the waves that are then observed. This excitation would have to be a continuous supply of energy and have the result that $k \ll \omega_0/C_s$ (where k is the wavenumber, ω_0 is the cutoff oscillation frequency, and C_s is the sound speed), which gives frequencies around the cutoff.

To investigate the response of a medium to excitations, a simple, initially static model atmosphere was created. Dimensionless parameters for wave velocity, mass density, pressure, and the displacement due to perturbation of the medium were evolved through time after a perturbation was introduced. Important relations such as the wave equation and dispersion relation, along with reasonable boundary and initial conditions produced a solution for the wave speed at any time and any height in the atmosphere. Using conservation of energy (i.e. the total energy in the system remained constant), two limiting cases were produced: one with most of the energy going to components with small wavenumbers or large wavenumbers, were the small wavenumber components were expected to be the source of the three-minute oscillations. The simulations addressed the dispersive behavior of the waves in a gravitationally stratified medium (g changes with height), the energy carried and dispersed by the waves, and the possible sources of this energy that could result in continuous oscillations.

The three-minute periods were found to be freely propagating (i.e. no driving force present after the initial excitation) dispersive waves whose frequency rapidly dropped due to energy loss. The damping of high-frequency waves first, followed by lower frequency waves later, explained the drop in power beyond the cutoff frequency, where the transport of mechanical energy became quite inefficient. The low-frequency waves moved with a group velocity that was so low ($v_{gr} \ll c_s$), they appeared to 'linger' at a given location, giving the false impression of being standing oscillations. The source of energy powering these oscillations was attributed to either the continuous photospheric motions caused by convective turbulence in the solar interior, or velocity impulses from impulsive disturbances in the upper photosphere.