INSTABILITIES IN A POLYTROPIC ATMOSPHERE

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Abstract

The density in the outer layers of stars varies by several orders of magnitude and it is desirable to include the full effects of compressibility in any study of instabilities arising in stellar convection zones. In an unstable compressible fluid-layer that is thermally conducting both the oscillatory and non-oscillatory motions can simultaneously arise. The conditions under which the oscillatory acoustic modes can be overstabilized in a polytropic atmosphere are examined. It is argued that the linearized perturbation theory breaks down when applied to an inviscid complete polytrope which has vanishing density and temperature at the top for both optically-thin and optically-thick approximations. However, the linearized theory is demonstrated to be self-consistent when viscosity and thermal conductivity are included in the study of complete polytropes.

ON THE DYNAMICS OF THE SOLAR CONVECTION ZONE

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Abstract

We derive expressions for the turbulent viscosity and turbulent conductivity applicable to convection zones of rotating stars. We assume that the dimensions of the convective cells are known and derive a simple distribution function for the turbulent convective velocities under the influence of rotation. From this distribution function (which includes, in particular, the stabilizing effect of rotation on convection) we calculate in the mixing-length approximation: i) the turbulent Reynolds stress

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