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Title: Outgoing solution and radiation conditions for scalar wave equation in helioseismology without flow

Abstract: In this talk, we consider the question of how to define physical solution for the scalar wave equation in helioseismology without flow. With the Louiville change of variable, the equation is rewritten as a Schrodinger equation. Assumptions such as ideal atmospheric pressure leads to a Coulomb-like potential with mild singularity at the origin. Using the scattering theory of Ikebe-Saito for long-range potential, one can define physical solutions for this equation, which decay in the absence of attenuation and behave like expanding spherical waves at infinity. In this way, the physical solutions of the original problem are exactly defined in terms of the physical solutions of the conjugate problem. This is the theoretical contribution of the work. On the practical side, we obtain the exact Dirichlet-to-Neumann map in the atmosphere with ideal atmospheric assumption which is used to evaluate radiation boundary conditions. In addition, we provide explicit expression of the 3D kernel and its harmonic expansion in terms of Whittaker functions in the toy case where the ideal atmospheric assumption is extended to the whole domain. These are used as references to evaluate the accuracy of discretization schemes. In the second part, we show numerical comparisons of radiation boundary conditions constructed from the conjugate equation under ideal atmospheric assumption with the existing ones in literature.

It is a joint work with H. Barucq, L. Gizon, F. Faucher and D. Fournier