From Navier-Stokes to discontinuous solutions of compressible Euler

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The compressible Euler equation can lead to the emergence of shock discontinuities in finite time, notably observed behind supersonic planes. A very natural way to justify these singularities involves studying solutions as inviscid limits of Navier-Stokes solutions with evanescent viscosities.The mathematical study of this problem is however very difficult because of the destabilization effect of the viscosities.

Bianchini and Bressan proved the inviscid limit to small BV solutions using the so-called artificial viscosities in 2004. However, until very recently, achieving this limit with physical viscosities remained an open question.

In this presentation, we will provide the basic ideas of classical mathematical theories to compressible fluid mechanics and introduce the recent method of a-contraction with shifts. This method is employed to describe the physical inviscid limit in the context of the barotropic Euler equation, and to solve the Bianchini and Bressan conjecture in this special case. This is a joint work with Geng Chen and Moon-Jin Kang.