# Singular limits: mathematical derivation of the equations describing objects called "accretion disk",rotating fluids

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**Abstract**

We study the 3-D compressible barotropic Navier-Stokes-(Fourier)- Poisson system describing the motion of a compressible rotating viscous fluid with renormalized gravitation, confined to a straight layer $\Omega_\epsilon = \omega \times (0, \epsilon)$, where $\omega$ is a 2-D domain. We shall show that the weak solutions in the 3D domain converge to the strong solution of a rotating 2-D Navier-Stokes-(Fourier)-Poisson system on $\omega$ as $\epsilon \to 0$ for either all times less than the maximal life time of the strong solution of the 2-D system or the initial data are small when the Froude number is small ($Fr = \mathcal{O}(\sqrt{\epsilon})$. We consider just the selfgravity force. In the second case we consider a rotating pure 2-D Navier-Stokes-(Fourier) system on $\omega$ as $\epsilon \to 0$ when $Fr = \mathcal{O}(1)$ in the case of the external gravity see [1, 2]. We consider the inviscid incompressible limits of the rotating compressible Navier-Stokes system for a barotropic fluid. We show that the limit system is represented by the rotating incompressible Euler equation on the whole space see [3].

# References

[1] B. Ducomet, M. Caggio, Š.Nečasová, and M. Pokorný: The rotating Navier–Stokes–Fourier–Poisson system on thin domains, Preprint 2016

[2] B. Ducomet, Š.Nečasová, M. Pokorný and M. A. Rodríguez - Bellido: Derivation of the Navier - Stokes - Poisson system for an accretion disk, Preprint 2016

[3] M. Caggio, Š.Nečasová: Inviscid incompressible limits for rotating fluids Nonlinear Analysis, Theory, Methods and Applications 163, 2017, 1–18