87st MSS-Seminar
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Kinetic theory of cohesive granular particles

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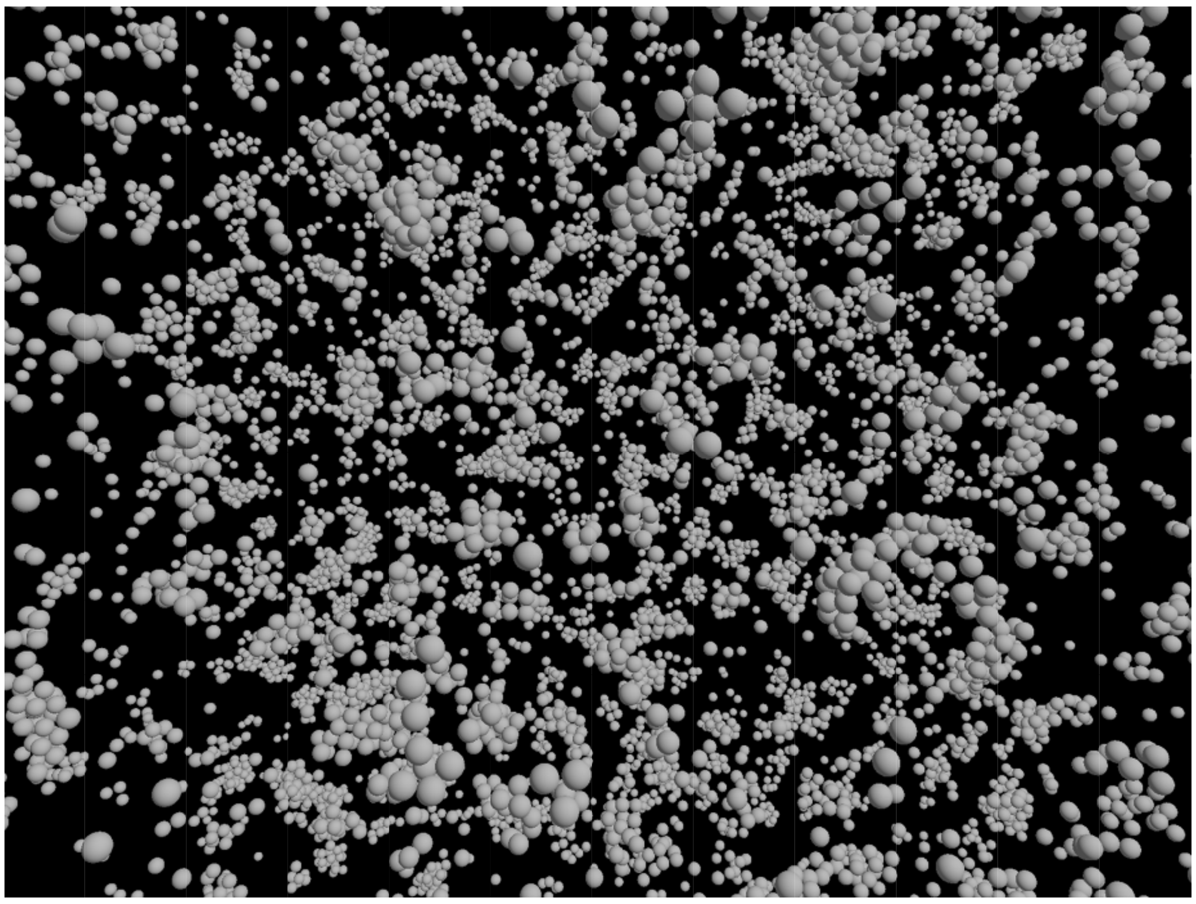

Because granular materials are ubiquitous in our daily lives, to understand their properties is important in both physics and industry. Granular materials behave as unusual solids, liquids, and gases. Even though we consider the most idealistic case, a system for a dilute gas without any external force, the system cannot maintain a homogenous state due to inelastic collisions between grains. Such inhomogeneity can be understood by the instability of granular hydrodynamics. Although the interaction between idealistic granular materials are assumed to be repulsive short range force, cohesive force cannot be ignored for fine powders or wet granular system.
In a previous study [1], we have shown the appearance of various phases for cohesive powders under a plane shear. We have also demonstrated that the dynamic van der Waals model under a plane shear can reproduce such phases and clarified the mechanism of the instability which is mainly caused by the cohesive force for small systems [2].
In this study, we extend the kinetic theory of the inelastic hard core system to the nearly elastic granular gases whose attractive part is given by a square well potential. We derive a set of hydrodynamic equations using the Chapman-Enskog theory and obtain the dissipation rate and the transport coefficients of this system.
We also examine the direct simulation Monte Carlo to verify the validity of the kinetic theory.

References
[1] S. Takada, K. Saitoh, and H. Hayakawa, Phys. Rev. E 90, 062207 (2014).
[2] K. Saitoh, S. Takada, and H. Hayakawa, Soft Matter, 11, 6371