論文 / 著書情報
Article / Book Information

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Title(English)	Toward Formation of Rocky Planetesimals: Evolution of Local Dust-Gas Density Structure and Growth of Dust Particles at Radial Pressure Bump in Protoplanetary Disks
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種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	地球惑星科学	専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of	（ 理学 ）
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

We investigate the simultaneous evolution of dust and gas density profiles at a radial pressure bump located in a protoplanetary disk. In addition, we include the effect of the dust growth to the dust and gas dynamics self-consistently.

In a framework where dust particles are treated as test particles, a radial pressure bump has been known to trap dust particles that drift radially inward otherwise under non-zero pressure support in a gas disk. As the dust particles are concentrated at the gas pressure bump, however, the drag force from dust to gas, which is ignored in a test-particle approach, may deform the gas profile. Indeed we find that the pressure bump is completely deformed by the dust drag force when the dust-to-gas mass ratio reaches ~ 1 in the case of slower bump restoration. Direct gravitational instability of dust particles is inhibited by the bump destruction.

In the dust enriched region of the dust-to-gas mass ratio ~ 1, the radial pressure support becomes ~ 10-100 times smaller than the global value set initially. Although the pressure bump is a favorable place for streaming instability (SI), the flattened pressure gradient inhibits SI from forming large particle clumps corresponding to 100-1000 km-sized bodies, which has been previously proposed. If streaming instability occurs there, the dust clumps formed would be 10-100 times smaller than previously thought. The estimated size of the resultant planetesimal is ~ 1-100 km.

On the other hand, the dust dense region which has small pressure gradient and relatively high dust-to-gas ratio is favorable location for the direct sticking of dust particles. We conduct simplified 1-D simulations which include effects of dust growth. We confirm that the dust dense region formed by the radial pressure bump encourages the dust growth. Dust particles quickly pass the size corresponding to St=1 at the pressure bump, and the gas drag law also changes into Stokes law. Even if the dust dense region is destroyed by the global disk evolution, the growth timescale of such dust particles is smaller than the radial drift timescale in the nominal minimum mass solar nebula model. Therefore a pressure bump may be a good location for the formation of *classic* planetesimals due to streaming instability or direct sticking.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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