SPICA望遠鏡による遠赤外線偏光観測で探る原始惑星系円盤のダスト特性

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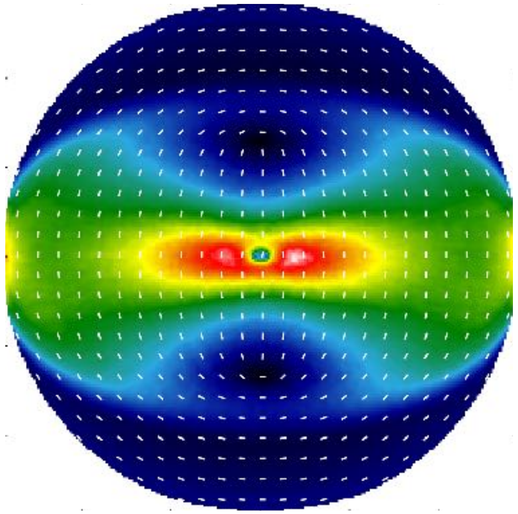
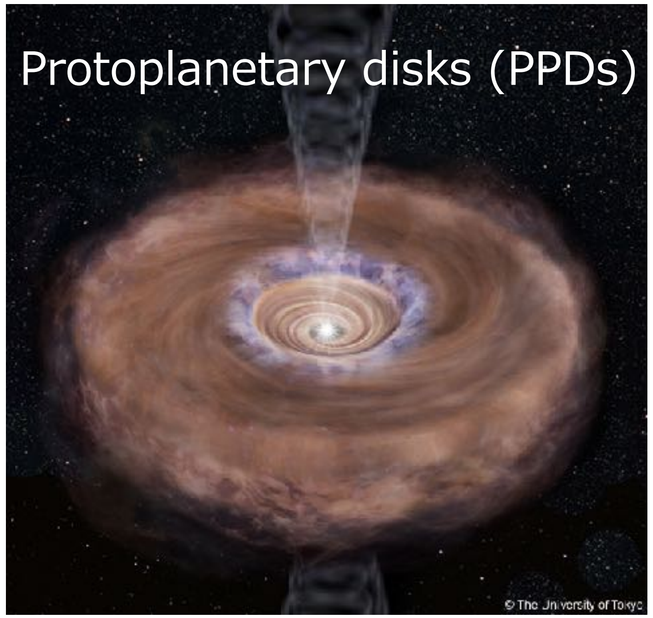
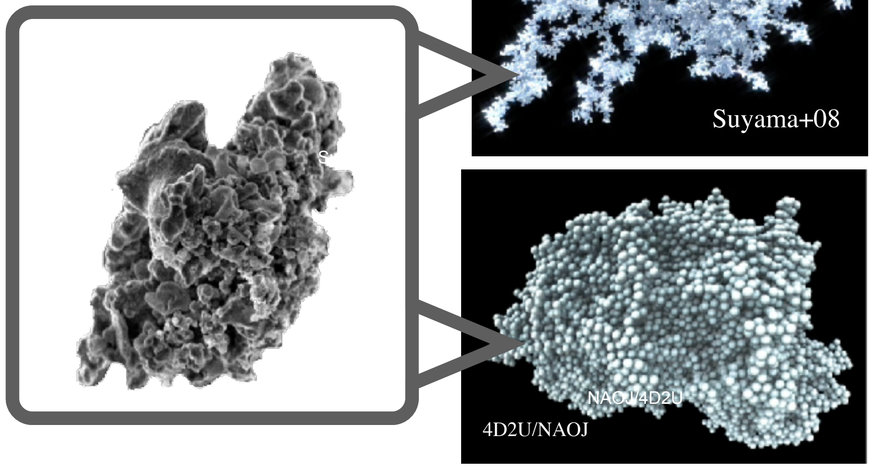


From dust to planetesimal

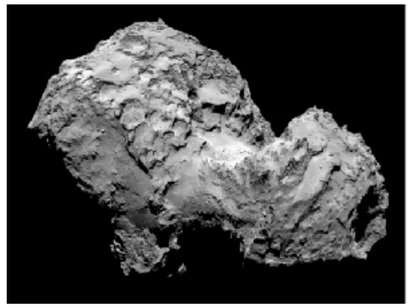


Dust (~μm)



Direct coagulation?
(Okuzumi+12, Kataoka+13)

Planetesimal (~km)



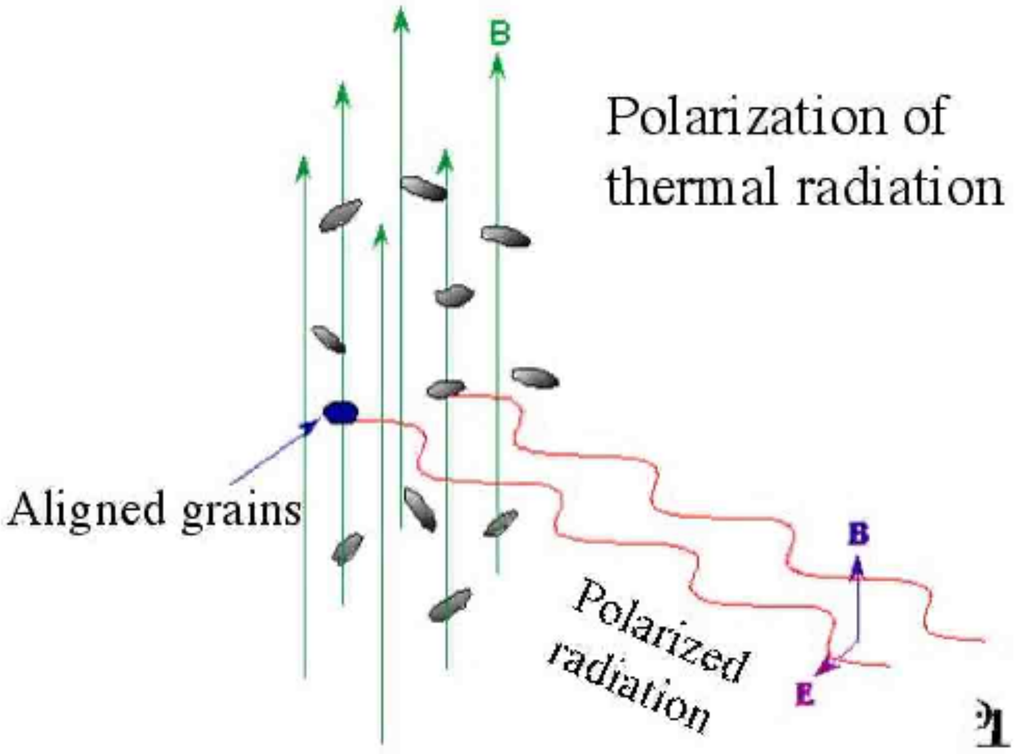
Hydrodynamical accumulation?
(e.g., Youdin & Goodman 05)

- Planetesimal formation is a long-standing problem
- Dust porosity is a key to understand planetesimal formation (e.g., Blum 2018)

What will SPICA/B-BOP tell us about dust size and porosity?

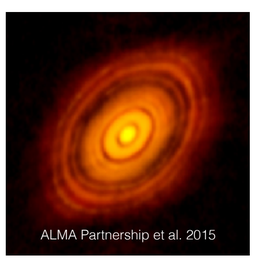
Origin of polarization in disks

Grain alignment

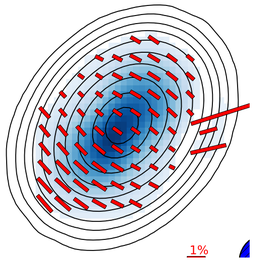


B-field morphology
(if B-field alignment occurs)

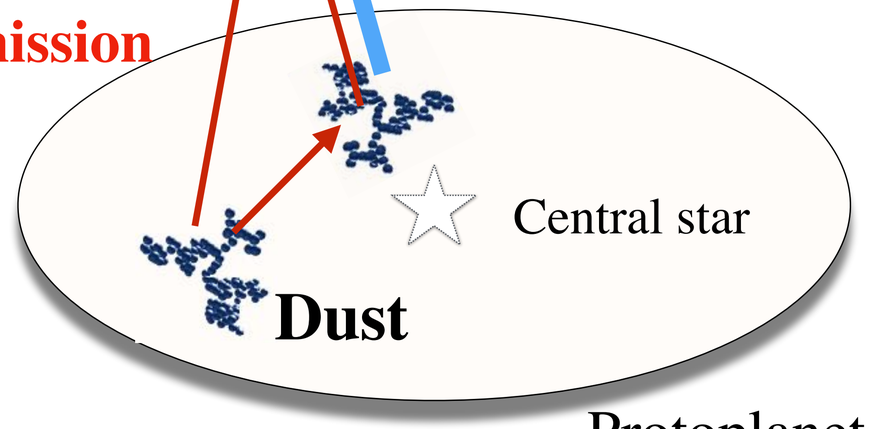
Self-scattering



Thermal Emission



Scattered light (polarized)

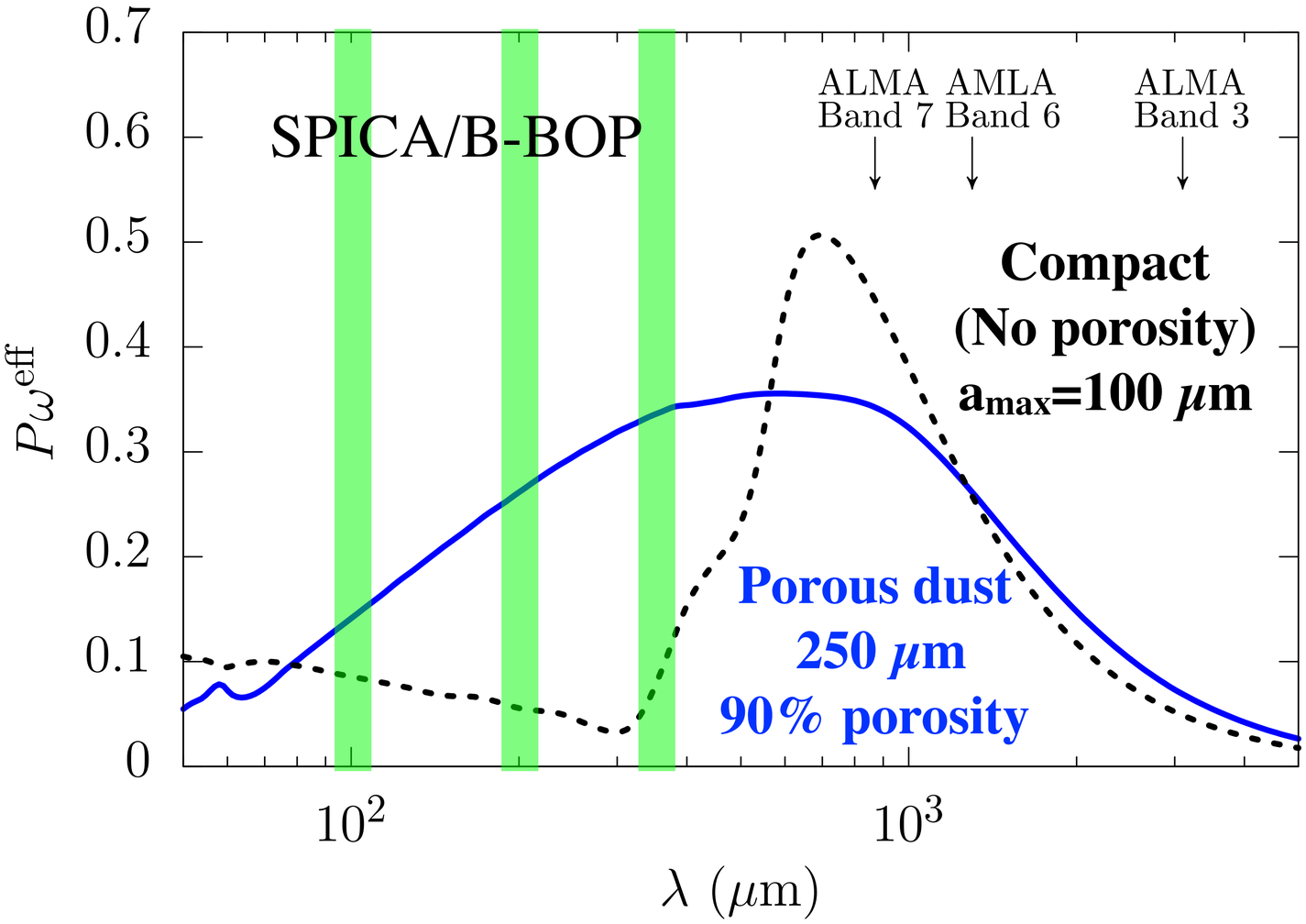


Protoplanetary disks

Dust properties

Grain polarization property at FIR wavelength

Tazaki et al. 2019b, ApJ, 885, 52



- Weaker wavelength dependence for more porous dust particles
- SPICA observations may reveal porosity of dust particles seen in ALMA polarimetry

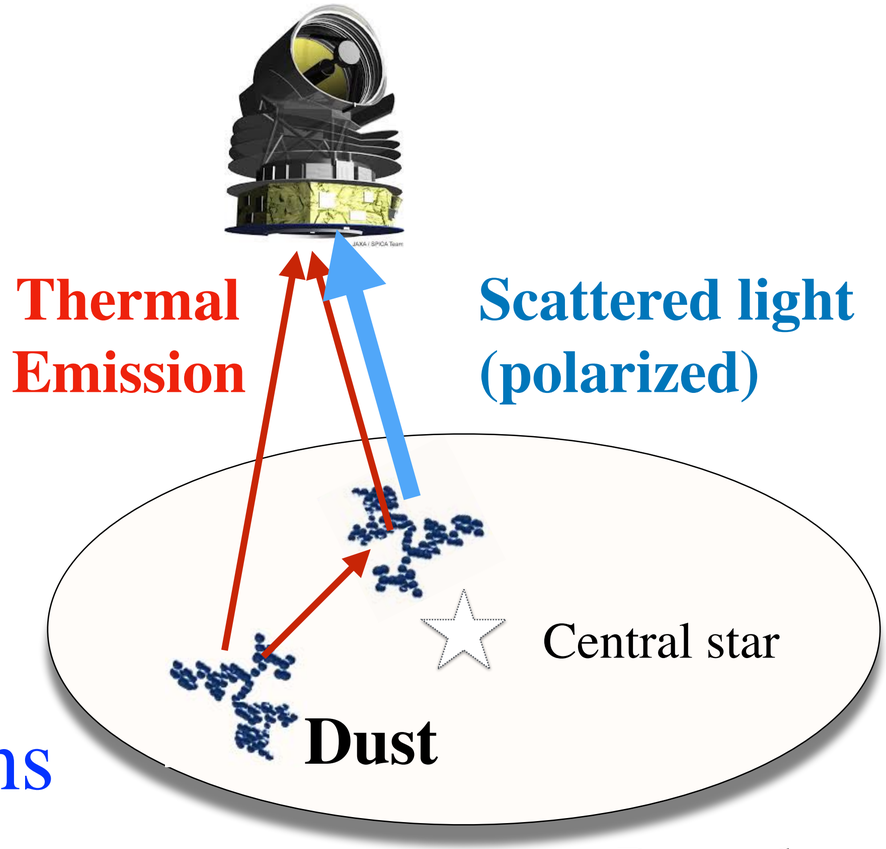
Porous dust particles have an ability to cause self-scattering at FIR!

Aim of this study

No quantitative study of self-scattering in disks at SPICA wavelengths

Questions:

- How does dust porosity affect disk polarization?
- Can we detect polarized signals due to self-scattering with SPICA/B-BOP instrument?



We perform radiative transfer simulations to answer these questions.

Protoplanetary disks

Summary

- We have studied how dust size and porosity affect self-scattering at FIR wavelengths.
- We have confirmed that SPICA/B-BOP can detect polarization signal due to self-scattering as long as the disk is moderately inclined.
- It is found that dust porosity changes wavelength dependence of scattering polarization.
  - Weaker wavelength dependence for more porous particles
- Polarimetry from FIR to (sub-)mm by SPICA and ALMA is a powerful tool to infer dust porosity, leading to better understandings of planetesimal formation.