

Computational science of dust coagulation process in protoplanetary disk turbulence

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By using recent supercomputers, it is becoming possible to use larger-scale direct numerical simulation (DNS) of high-Reynolds-number (Re) turbulence for understanding complex turbulent flow phenomena. Coagulation process of silicate dusts in protoplanetary disk is one of the most challenging problems in planetary science. By tracking huge number (more than one billion) of inertial particles in high Re turbulence, we could simulate turbulent clustering of particles directly and quantitatively. Our DNS of turbulence showed that dust coagulation is expedited by turbulence clustering of particles. The next step is to realize dust growth simulations to quantitatively estimate the growth rate of dust particles and the size-distribution in high Re turbulence. In the presentation, what we have obtained so far and what we are trying will be discussed.