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Dust Settling in Protoplanetary Disks and the Onset of Kelvin-Helmholtz Instability JOSEPH BARRANCO, San Francisco State University, AARON LEE, EUGENE CHIANG, PHILIP MARCUS, University of California, Berkeley, XYLAR ASAY-DAVIS, Los Alamos National Laboratory — It is a remarkable fact that planets start out as microscopic grains within the protoplanetary disks of gas and dust in orbit around newly-formed protostars, somehow growing by a factor of 10^{40} in mass in a period no more than 10^{7} years. In the early stages of the planet formation process, small dust grains settle into the midplane of the disk in a few thousand years. As the dust layer gets thinner and denser, a vertical shear develops between the dust-rich layer at the midplane and the dust-poor gas above and below this layer. Of great interest is under what conditions such a layer will be unstable to Kelvin-Helmholtz instability (KHI), which will remix the dust with the gas, thwarting the formation of planets. In our previous work, we worked in the single-fluid limit in which the local dust-to gas ratio was an advectively conserved quantity (valid when the dust-gas friction time is very short). Here, we present new simulation in which this assumption is relaxed. We employ 2-fluid simulations of dust and gas to explore the evolution of a dust layer in the more general case in which the dust grains and gas can slip through each other. We will describe conditions that allow the dust layer to settle to sufficient density to gravitationally clump-up to form planetesimals before the onset of KHI.

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