

Oceanography Seminar

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Yielding in granular materials, from riverbeds to renormalization group

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Yield-stress behavior in granular materials (e.g., sand or soils) is relevant to a wide variety of engineering and geophysical processes. One notable example is along riverbeds, where sediment transport occurs only above a minimum fluid flow rate. Sediment transport is a complex process, so simplifying assumptions are often necessary. Previous studies have typically used a detailed treatment of the fluid mechanics with a simpler description of the grains. In this talk, I will describe the results of numerical simulations modeling sediment transport where we take the opposite approach, focusing on the grains instead of the fluid. We find that a grain-focused approach gives significant insight into the shape of the Shields curve, a century-old collection of experimental and field data measuring the onset of sediment transport as a function of grain size. We also find that grain rearrangements become spatially correlated over arbitrarily large distances near the yield stress, implying that a collective description of grains is necessary to understand the onset of sediment transport.