

Abstract Submitted  
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**Unveiling Hidden Phases of Solid  $4\text{He}$** <sup>1</sup> H. CHOI, S. KWON, D.Y. KIM, E. KIM, Department of Physics and Center for Supersolid and Quantum Matter Research, KAIST, Daejeon, South Korea — The discovery of non-classical rotational inertia fraction (NCRIF) of solid  $4\text{He}$  in a torsional oscillator (TO) was immediately followed by various attempts to identify the underlying physics of the phenomenon. Despite the efforts the true nature of the non-classical response is still not fully understood. We have investigated dynamic response of solid  $4\text{He}$  by changing oscillation rim velocity at fixed temperatures. Main discovery of our experiment is that there are hidden phases of solid  $4\text{He}$  that are only accessible by cooling the sample down to some temperature with zero to small rim velocity first, and then subsequently raising the velocity at that temperature. The different phases are identified with two distinct features. One is that the amount of NCRIF is different from that of a typical high-velocity cooled  $4\text{He}$ . The other is that the dynamics of the TO changes across these different phases. We believe these phases are distinguished by different pinning mechanisms of excitations present in  $4\text{He}$ .

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Eunseong Kim  
Department of Physics and Center for Supersolid and Quantum  
Matter Research, KAIST, Daejeon, South Korea

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