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**Connections between the Boson peak and the Van Hove Singularity— insights from the normal modes analysis of granular experiments** LING ZHANG, JIE ZHENG, JIE ZHANG, Shanghai Jiaotong University — We have experimentally measured the density of states (DOS) from the hexagonal lattice to the disordered structures in 2D packing of granular materials, which are made of photo-elastic disks allowing a precise measurement of contact forces between disks to determine the dynamical matrix of the system. Two different analyses have been performed with and without the inclusion of the rotational degree of freedom. By varying the pressure of the disordered crystal, we find the strong evidence that the first Van Hove singularity gradually evolves into the Boson peak. In geometrically disordered packing, the position of the Boson peak is influenced by the degree of the geometric disorder. Incorporating the rotational degree of freedom, two peaks would appear at the vicinity of the original first Van Hove singularity in the hexagonal lattice and similarly at the vicinity of the original Boson peak in a disordered crystal; in a contrast, the two peaks are nearly merged in a geometrically disordered system. Moreover, further analysis shows that the first peak is only related to the rotational degree of freedom, whereas the second peak is due to the coupling between the rotational and translational degrees of freedom.

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