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Resonance Van Hove Singularities in Weak Wave Turbulence YI-KANG SHI, GREGORY EYINK, The Johns Hopkins University — Wave kinetic theory has been developed by Hasselmann, Benney, and others to describe turbulence of weakly nonlinear, dispersive waves. However, systems which are generally dispersive can have resonant sets of wave modes with identical group velocities, leading to a local breakdown of dispersivity. This shows up as a geometric singularity of the resonant manifold and possible divergence of the phase measure in the collision integral. Such singularities occur widely, including acoustical waves, Rossby waves, helical waves in rotating fluids, etc. These singularities are the exact analogue of the critical points found by Van Hove in 1953 for phonon dispersion relations in crystals. The importance of these singularities in wave kinetics depends on the dimension of phase space D=(N-2)d (d physical space dimension, N the number of waves in resonance) and the degree of degeneracy of the critical points. Following Van Hove, we show that point (non-degenerate) singularities produce no divergences for D>2 but lead to logarithmic divergences when D=2 and possible breakdown of wave kinetics. These divergences are not removed by nonlinear broadening of the resonances. We discuss an example of Michel et al. (2010) for optical turbulence (N=4,d=1). When D>2, breakdown can occur for degenerate critical points which live on higher-dimensional lines and surfaces. We give examples for inertial waves in rotating fluids (N=3,d=3) and the dilute electron-hole plasma in graphene (N=4, d=2).

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