



Universal power law for the spectrum of breaking Riemann waves

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The universal power law for the spectrum of one-dimensional breaking Riemann waves is justified for the simple wave equation with arbitrary nonlinearity. This equation describe the long surface and internal wave in the coastal zone. The spectrum of spatial amplitudes at the breaking time has an power asymptotic decay with exponent $-4/3$. This spectrum is formed by the singularity of the form like $\hat{x}^{1/3}$ in the wave shape at the breaking time. In addition, we demonstrate numerically that the universal power law is observed for long time in the range of small wave numbers if small dissipation or dispersion is accounted in the viscous Burgers or Korteweg–de Vries equations.