The Stability of Travelling Waves with Algebraic Decay for Autocatalytic Reaction Systems

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Abstract:
It’s a joint work with Yi Li, Univ. of Iowa.
Consider the following autocatalytic chemical reaction system
\[
\begin{align*}
  u_t &= u_{xx} - u^q v^p, \\
  v_t &= dv_{xx} + u^q v^p.
\end{align*}
\]

For \( p \geq 1, q \geq 1 \) and \( d > 0 \), it is known that there exists a critical speed \( c^*(p, q, d) \) such that for any \( c \geq c^*(p, q) \) there exist travelling front solutions \((u(x - ct), v(x - ct))\) connecting \((0, 1)\) and \((1, 0)\). For the cases \( p > 1 \) or \( q > 1 \), the travelling waves with noncritical speed decay algebraically in space at \(+\infty\) or \(-\infty\).

In this talk we shall be more interested in the asymptotic stability of the waves with noncritical speed and algebraic spacial decay for \( p > 1 \) and \( q \geq 1 \). We shall first talk about our recent work on the asymptotic stability of the waves with algebraic decay in some polynomially weighted spaces for the system with equal diffusion rates. Further we shall talk about our recently obtained abstract results on the existence and analyticity of Evans function for the more general ODE systems with slow algebraic decaying coefficients, and our recent work on the linear and nonlinear exponential stability of waves with algebraic decay when the diffusion rates are close.