Slowly oscillating wavefronts of the KPP-Fisher delayed equation

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This paper concerns the semi-wavefronts (i.e. bounded solutions $u=\phi(x \nu +ct) >0,$ $ |\nu|=1, $ satisfying $\phi(-\infty)=0$) to the delayed KPP-Fisher equation $$u_t(t,x) = \Delta u(t,x) + u(t,x)(1-u (t-\tau,x)), \ u \geq 0,\ x \in \R^m. \eqno(*)$$ First, we show that each semi-wavefront should be either monotone or slowly oscillating. Then a complete solution to the problem of existence of semi-wavefronts is provided. We prove next that the semi-wavefronts are in fact wavefronts (i.e. additionally $\phi(+\infty)=1$) if $c \geq 2$ and $\tau \leq 1$; our proof uses dynamical properties of some auxiliary one-dimensional map with the negative Schwarzian. The analysis of the fronts' asymptotic expansions at infinity is another key ingredient of our approach. It allows to indicate the maximal domain ${\mathcal D}_n$ of (τ,c) where the existence of non-monotone wavefronts can be expected. Here we show that the problem of wavefront's existence is closely related to the Wright's global stability conjecture.

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