Heteroclinics for a mean curvature problem in Lorentz-Minkowski space

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We consider the singular action functional

$$\int_{\mathbb{R}\times\omega} 1 - \sqrt{1 - |\nabla u|^2} + W(u) \ dx,$$

which plays a role in special relativity. Here, we assume that $\omega \subset \mathbb{R}^{N-1}$ is a bounded domain and $W \colon \mathbb{R} \to [0, +\infty[$ is a double-well potential, i.e., W is of class C^1 and satisfies $W(-1) = W(1) = 0$ and $W(u) > 0$ if $u \neq \pm 1$.

Using variational arguments and a rearrangement technique, we prove the existence, one-dimensionality and uniqueness (up to translations) of a smooth minimising phase transition between the stable states -1 and 1.

We also discuss the existence of minimising heteroclinic connections for the nonautonomous model

$$\int_{\mathbb{R}} 1 - \sqrt{1 - |u'|^2} + a(t)W(u) \ dt,$$

where $a \in L^{\infty}(\mathbb{R})$ is a positive function that can have a constant asymptotic behaviour at infinity or can be periodic.

The talk is based on joint work with Denis Bonheure and Manon Nys.