

Nonuniqueness for a critical nonlinear heat equation with any initial data

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Abstract: We establish, for any initial data $u_0 \in L^{\frac{n}{n-2}}(\mathbb{R}^n)$, with $n \geq 3$, the existence of an infinite number of solutions of the Cauchy problem for the nonlinear heat equation

$$\begin{cases} \partial_t u = \Delta u + |u|^{\frac{2}{n-2}} u & \text{in } (0, T) \times \mathbb{R}^n, \\ u(0) = u_0 & \text{in } \mathbb{R}^n, \end{cases}$$

in the class $C([0, T], L^{\frac{n}{n-2}}(\mathbb{R}^n))$.