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Existence of a positive solution to a nonlinear scalar field equation with zero mass at infinity

Abstract: We establish the existence of a positive solution to the problem

$$-\Delta u + V(x)u = f(u), \qquad u \in D^{1,2}(\mathbb{R}^N), \tag{1}$$

for N≥3, when the nonlinearity *f* is subcritical at infinity and supercritical near the origin, and the potential *V* vanishes at infinity.

For $V \equiv 0$ this problem was addressed by Berestycki and Lions in their groundbreaking paper published in ARMA in 1983. They called it the *zero mass* case.

Our result includes situations in which problem (1) does not have a ground state. Then, under a suitable decay assumption on the potential *V*, we show that it has a positive bound state.

This is joint work with Liliane Maia (University of Brasilia).

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