

MR2083437 (2006a:35074) [35J60](#) ([35B25](#) [35Q60](#) [47J30](#))

Cao, Daomin (PRC-ASBJ-MSY); Noussair, Ezzat S. (5-NSW-SM); Yan, Shusen (5-SYD-SM)

On the profile of solutions for an elliptic problem arising in nonlinear optics. (English summary)

Discrete Contin. Dyn. Syst. **11** (2004), no. 2-3, 649–666.

Summary: “We study the profile of solutions of the problem

$$\begin{cases} -\Delta u + (\lambda - h(x))u = g(x)(u^{p-1} + f(u)) & \text{in } \mathbb{R}^N, \\ u > 0 & \text{in } \mathbb{R}^N, \quad u \in H^1(\mathbb{R}^N), \end{cases}$$

where $\lambda > 0$ is a parameter, h and g are nonnegative functions in $L^\infty(\mathbb{R}^N)$. We obtain the asymptotic behaviour of the least energy solutions or solutions obtained by the minimax principle. From the asymptotic behaviour we conclude that those solutions are asymmetric for λ large even if h and g are radially symmetric.”

References

1. R.V. Akhmanov, R.V. Khokhlov and A.P. Sukhorukov, ”Self-focusing, self-defocusing and self-modulation of laser beams,” *Laser Handbook*, North-Holland, Amsterdam, 1972.
2. N.A. Akhmediev, *Novel class of nonlinear surface waves: Asymmetric modes in a symmetric layered structure*, *Sov. Phys. JEPT*, 56(1982), 231–247.
3. A. Ambrosetti, D. Arcoya and J.L. Gámez, *Asymmetric bound states of differential equations in nonlinear optics*, *Rend. Sem. Mat. Univ. Padova*, 100(1998), 1–13. [MR1675283 \(99m:34103\)](#)
4. A. Ambrosetti and Z.-Q. Wang, *Positive solutions to a class of elliptic equations on \mathbb{R}* , *Discrete and Continuous Dynamical Systems*, 9(2003), 55–68. [MR1951313 \(2003m:34050\)](#)
5. D. Arcoya, S. Cingolani, and J.L. Gámez, *Asymmetric modes in symmetric nonlinear optical wave guides*, *SIAM Math. Anal.*, 30(1999), 1391–1400. [MR1718307 \(2000j:78012\)](#)
6. A. Bahri and Y.Y. Li, *On a min-max procedure for the existence of a positive solution for certain scalar field equations in \mathbb{R}^N* , *Revista Math. Iber.*, 6(1990), 1–15. [MR1086148 \(92b:35054\)](#)
7. A. Bahri and P.L. Lions, *On the existence of a positive solution of semilinear elliptic equation in unbounded domains*, *Ann. Inst. H. Poincaré, Anal. Non Linéaire*, 14(1997), 365–413. [MR1450954 \(98k:35047\)](#)
8. H. Berestycki and P.L. Lions, *Nonlinear scalar field equations I. Existence of ground state*, *Arch. Rat. Mech. Anal.*, 82(1983), 313–345. [MR0695535 \(84h:35054a\)](#)
9. H. Brezis and E. Lieb, *A relation between pointwise convergence of functions and convergence of functionals*, *Proc. Amer. Math. Soc.*, 8(1983), 486–490. [MR0699419 \(84e:28003\)](#)
10. H. Brezis and L. Nirenberg, *Positive solutions of nonlinear elliptic equations involving critical Sobolev exponents*, *Comm. Pure Appl. Math.*, 36(1983), 437–477. [MR0709644 \(84h:35059\)](#)
11. D. Cao, E.S. Noussair and S. Yan, *Existence and uniqueness results on single-peaked solutions of a semilinear problem*, *Ann. I.H. Poincaré, Anal. Non Linéaire*, 15(1998), 73–111.

[MR1614607 \(99d:35053\)](#)

12. D. Cao, E.S. Noussair and S. Yan, *Solutions with multiple "peaks" for nonlinear elliptic equations*, Proc. Royal Edin., 125A(1999), 73–111. [MR1686700 \(2000a:35052\)](#)
13. S. Cingolani and J.L. Gámez, *Asymmetric positive solutions for a symmetric nonlinear problem in \mathbb{R}^N* , Calc. Var. PDE, 11(2000), 97–117. [MR1777465 \(2001f:35121\)](#)
14. S. Cingolani and M. Lazzo, *Multiple positive solution to nonlinear Schrödinger equation with competing potential functions*, J.Diff. Equats., 160(2000), 118–138. [MR1734531 \(2000j:35079\)](#)
15. C. H. Clarke, "Optimization and nonsmooth analysis," John Willey and Sons, 1983. [MR0709590 \(85m:49002\)](#)
16. V. Coti Zelati and M.J. Esteban, *Symmetry breaking and multiple solutions for a Neumann problem in an exterior domain*, Proc. Royal Soc. Edin., 116A(1990), 327–339. [MR1084737 \(91j:35104\)](#)
17. E.N.Dancer and S.Yan, *On the existence of multipeak solutions for nonlinear field equations on \mathbb{R}^N* , Discrete and Continuous Dynamical Systems, 6(2000), 37–50. [MR1739592 \(2000k:35081\)](#)
18. M.J. Esteban, *Nonsymmetric ground states of symmetric variational problems*, Comm. Pure Appl. Math., 44(1991), 259–274. [MR1085830 \(91m:35073\)](#)
19. O. John and C. Stuart, *Guidance properties of a cylindrical defocusing wave guide*, Comm. Math. Univ. Carolinae, 35(1994), 653–373. [MR1321236 \(95m:78023\)](#)
20. M.K. Kwong, *Uniqueness of positive solutions of $\Delta u - u + u^p = 0$ in \mathbb{R}^n* , Arch. Rat. Mech. Anal., 105(1989), 243–266. [MR0969899 \(90d:35015\)](#)
21. Y.Y. Li, *Existence of multiple solutions of semilinear equations in \mathbb{R}^n* , Progr. Nonlinear Diff. Equats., 4(1990), 134–159.
22. P.L. Lions, *The concentration-compactness principle in the calculus of variations. The locally case, Part I*, Ann I.H. Poincaré, Anal. Non Linéaire, 1(1984), 109–145. [MR0778970 \(87e:49035a\)](#)
23. P.L. Lions, *The concentration-compactness principle in the calculus of variations. The locally case, Part II*, Ann. I.H. Poincaré. Anal. Non Linéaire, 1(1984), 223–283. [MR0778974 \(87e:49035b\)](#)
24. J.H. Marburger, *Self-focusing:theory*, Prog. Quant. Electr., 4(1975), 55–100.
25. Y.R. Shen, *Self-focusing, experimental*, Prog. Quant. Electr. 4(1975), 1–34.
26. C. Stuart, *Guidance properties of nonlinear planar waveguided*, Arch. Rat. Mech. Anal., 125(1993), 145–200. [MR1245069 \(94j:78022\)](#)
27. C. Stuart, *Self-trapping of an electromagnetic field and bifurcation from the essential spectrum*, Arch. Rat. Mech. Anal., 113(1991), 65–96. [MR1079182 \(91j:78010\)](#)
28. X.P. Zhu and D. Cao, *The concentration-compactness principle in nonlinear elliptic equations*, Acta. Math. Scientia, 9(1989), 307–328. [MR1043058 \(91i:35075\)](#)

Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.