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Singular limit and exact decay rate of a nonlinear elliptic equation

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(Submitted on 14 Jul 2011)

For any $n\ge 3$, $0< m\le (n-2)/n$, and constants $\cot 5$, $\cot 5$, \$\alpha\$, satisfying \$\alpha\le\beta(n-2)/m\$, we prove the existence of radially symmetric solution of \$\frac{n-1}{m}\Delta v^m+\alpha v +\beta x\cdot\nabla v=0, v>0, in R^n , $v(0)=\epsilon$, without using the phase plane method. When \$0<m<(n-2)/n\$, \$n\ge 3\$, and \$\alpha=2\beta/(1-m)>0\$, we prove that the radially symmetric solution \$v\$ of the above elliptic equation satisfies $\lim_{|x|\to \infty}\frac{|x|\cdot |x|}{1-m}}{\log |x|} = \frac{2(n-1)(n-2-nm)}{\delta (1-m)}}$ m)} $\$. In particular when $m=\frac{n-2}{n+2}$, $n\ge 3$, and $\alpha=2\beta$ (1-m)>0\$, the metric $g_{ij}=v^{\frac{4}{n+2}}dx^2$ \$ is the steady soliton solution of the Yamabe flow on \$\R^n\$ and we obtain \$\lim {|x|\to\infty}\frac $\{|x|^2v(x)^{1-m}\}\{\log |x|\}=\frac{(n-1)(n-2)}{\beta}. When $0< m<(n-2)/n$, $n\neq 0$ 3\$, and $2\left(1-m\right)\times (\alpha,0)$ \$, we prove that $\lim_{|x|\to 0}|x|^{\alpha}$ $\alpha \phi(x)=A$ for some constant \$A>0\$. For \$\beta>0\$ or \$\alpha=0\$, we prove that the radially symmetric solution \$v^{(m)}\$ of the above elliptic elliptic equation converges uniformly on every compact subset of \$\R^n\$ to the solution \$u\$ of the equation \$(n-1)\Delta\log u+\alpha u+\beta x\cdot\nabla u=0\$, \$u>0\$, in \$\R^n\$, \$u(0)=\eta\$, as \$m\to 0\$.

Comments: 19 pages

Subjects: Analysis of PDEs (math.AP); Differential Geometry

(math.DG)

MSC classes: Primary 35J60, 35B40 Secondary 34C11, 58J05

Cite as: arXiv:1107.2735 [math.AP]

(or arXiv:1107.2735v1 [math.AP] for this version)

Submission history

From: Shu-Yu Hsu [view email]

[v1] Thu, 14 Jul 2011 06:30:06 GMT (12kb)

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