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Entire Positive Solutions of Elliptic Systems: Understanding the General Structure. Preliminary report.

We study the structure of entire positive solutions of the semilinear elliptic system $\Delta u = p(|x|)v^\alpha,\ \Delta v = q(|x|)u^\beta$ on $\mathbf{R}^n$, $n \geq 3$, $\alpha,\ \beta > 0$, which arises in many practical areas and has interesting mathematical implications. We establish uniqueness results for bounded entire radial positive solutions for both the superlinear and sublinear cases. To do this, we require for solutions (u, v) and $(\tilde{u}, \tilde{v}$ fast convergence of $u - \tilde{u}$ and $v - \tilde{v}$ to zero, and the functions p and q have faster decay near infinity, namely,

$$\int_0^\infty t^{n-1} \max_{|x|=t} p(x)dt < \infty, \qquad \int_0^\infty t^{n-1} \max_{|x|=t} q(x)dt < \infty.$$

We will also show that

$$\lim_{R\to\infty} R^{n-2}z(R)$$

exists (i.e. is finite), where $z = u$ or $z = v$, thus further demonstrating that the fast convergence required of $u - \tilde{u}$ and $v - \tilde{v}$ is justified. We also discuss various properties of entire positive solutions. (Received August 17, 2006)