
Global existence and boundedness in a quasilinear degenerate Keller-Segel system

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Abstract

We study global existence and boundedness of weak solutions to the quasilinear degenerate Keller–Segel system

$$\begin{cases} u_t = \nabla \cdot (\nabla u^m - u^{q-1} \nabla v) & \text{in } \mathbb{R}^N \times (0, \infty), \\ v_t = \Delta v - v + u & \text{in } \mathbb{R}^N \times (0, \infty), \\ u(x, 0) = u_0(x), v(x, 0) = v_0(x), & x \in \mathbb{R}^N, \end{cases} \quad (\text{KS})$$

where $N \in \mathbb{N}$, $m \geq 1$, $q \geq 2$ and the initial data (u_0, v_0) is assumed to be a pair of non-negative functions. Global existence of weak solutions to (KS) was first established under the condition $q \leq m$ by Sugiyama and Kunii [2]. The condition for q was relaxed into the condition $q < m + 2/N$ by a joint work [1] with Sachiko Ishida. Both results gave only global existence and it is still open whether (KS) admits a weak solution that is uniformly-in-time bounded. We would like to give an answer to this open question.

References

- [1] S. Ishida, T. Yokota, *Global existence of weak solutions to quasilinear degenerate Keller-Segel systems of parabolic-parabolic type*, J. Differential Equations **252** (2012), 1421–1440.
- [2] Y. Sugiyama, H. Kunii, *Global existence and decay properties for a degenerate Keller-Segel model with a power factor in drift term*, J. Differential Equations **227** (2006), 333–364.

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