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Suppression of chemotactic blow-up by active advection

Yao Yao

(National University of Singapore)

Aula Azul, ICMAT

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Chemotactic blow up in the context of the Keller-Segel equation is an extensively studied phenomenon. In recent years, it has been shown that when the Keller-Segel equation is coupled with passive advection, blow-up can be prevented if the flow possesses mixing or diffusion-enhancing properties, and its amplitude is sufficiently strong. In this talk, we consider the Keller-Segel equation coupled with an active advection, which is an incompressible flow obeying Darcy's law for incompressible porous media equation and driven by buoyancy force. We prove that in contrast with passive advection, this active advection coupling is capable of suppressing chemotactic blow up at arbitrary small coupling strength: namely, the system always has globally regular solutions. (Joint work with Zhongtian Hu and Alexander Kiselev).

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