1078-35-98 **Andrea Louise Bertozzi*** (bertozzi@math.ucla.edu), 520 Portola Plaza, Department of Mathematics, UCLA, Los Angeles, CA 90095, and **Thomas Boris Laurent** and **Flavien Leger**.

Aggregation via the Newtonian potential and aggregation patches.

This paper considers the multidimensional active scalar problem of motion of a function $\rho(x,t)$ by a velocity field obtained by $v = -\nabla N * \rho$, where N is the Newtonian potential. This problem has connections to vortex dynamics for 2D fluids only the velocity field is a gradient flow rather than divergence free. We prove well-posedness of compactly supported $L^\infty \cap L^1$ solutions of possibly mixed sign. These solutions include an important class of solutions that are proportional to characteristic functions on a time-evolving domain. We call these aggregation patches because of their connection to classical vortex patches in fluid dynamics. Whereas positive solutions collapse on themselves in finite time, negative solutions spread and converge toward a self-similar spreading circular patch solution as $t \to \infty$. We give a convergence rate that we prove is sharp in 2D. In the case of positive collapsing solutions, we investigate numerically the geometry of patch solutions in 2D and in 3D (axisymmetric). We show that the time evolving domain on which the patch is supported typically collapses on a complex skeleton of codimension one. (Received November 26, 2011)