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Formation and Evolution of Target Patterns in Cahn-Hilliard Flows: An Extension of the Flux Expulsion Studies in MHD[1] XIANG FAN, Univ of California - San Diego, P H DIAMOND COLLABORATION, LUIS CHACON COLLABORATION — Spinodal decomposition is a second order phase transition for a binary liquid mixture to evolve from a miscible phase (e.g., water + alcohol) to two co-existing phases (e.g., water + oil). The Cahn-Hilliard model for spinodal decomposition is analogous to 2D MHD. We study the evolution of the concentration field in a single eddy in the 2D Cahn-Hilliard system to better understand scalar mixing processes in that system. This study extends investigations of the classic studies of flux expulsion in 2D MHD and homogenization of potential vorticity in 2D fluids. Simulation results show that there are three stages in the evolution: (A) formation of a jelly roll pattern, for which the concentration field is constant along spirals; (B) a change in isoconcentration contour topology; and (C) formation of a target pattern, for which the isoconcentration contours follow concentric annuli. In the final target pattern stage, the isoconcentration bands align with stream lines. The results indicate that the target pattern is a metastable state. Band merger process continues on a time scale exponentially long relative to the eddy turnover time. The band merger process resembles step merger in drift-ZF staircases.

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