Nonlinear Sciences > Pattern Formation and Solitons

# Bifurcation of robust heteroclinic cycles in spherically invariant systems with $\ell =3,4$ mode interaction

Pascal Chossat, Philippe Beltrame

*(Submitted on 18 Dec 2009)*

Bifurcation with spherical symmetry and mode interaction is known to produce robust heteroclinic cycles between axisymmetric steady-states. The case of mode interaction with representations of $\SO3$ of degrees $\ell=1$ and 2 has been studied in the context of the onset of convection in a spherical shell and central gravity force by \cite{ArCh91} and \cite{ChGuLa99} who explained certain numerical observations made in 1986 by Friedrich and Haken \cite{FriHak86}. This problem has recently regained interest thanks to the launch of an experiment of convection between two concentric spheres in the International Space Station, thus providing a system with (nearly) spherical symmetry (GeoFlow project, see \cite{egbersetal}). In this case however, the onset of convection cannot be excited by modes of degree $\ell$ smaller than 3 due to technical constraints. Motivated initally by this experiment, we have analyzed the occurence of robust heteroclinic cycle in the case of $\ell=3, 4$ mode interaction. This case is highly complex but, applying the methods of equivariant bifurcation theory, we have shown the existence of (generalized) robust heteroclinic cycles involving, not only axisymmetric states, but also and principally states with cubic symmetry. These objects are observable in the numerical simulations of the dynamics on the center manifold. We provide video clips showing the corresponding evolution of the pattern on the sphere.

Comments: 25 pages, 12 figures
Subjects: **Pattern Formation and Solitons (nlin.PS)**; Chaotic Dynamics (nlin.CD)
Cite as: **arXiv:0912.3709v1 [nlin.PS]**

## Submission history

From: Philippe Beltrame [view email]
**[v1]** Fri, 18 Dec 2009 15:44:04 GMT (1049kb)

*Which authors of this paper are endorsers?*