Bifurcations on spheres and hemispheres: convection in planets and branching of plant tips

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Interest in convection in planet interiors has motivated the study of the onset of convective patterns in Navier-Stokes systems with spherical shell domains. Busse pointed out that a large part of this problem is "model-independent" and depends only on the fact that a generic bifurcation takes place in the presence of spherical symmetry. Methods of equivariant bifurcation theory developed in the last twenty years have been applied to make model-independent predictions for bifurcations with spherical symmetry. For certain problems, these predictions can be modified and used for bifurcations on hemispherical domains. We study one such problem, arising from chemical reaction-diffusion modelling of how a growing plant tip can "decide" to branch into two. With the use of symmetry, chemical patterns in the hemispherical surface can be related to convection patterns in a spherical shell.