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Symmetry breaking via global bifurcations in Taylor-Couette flow[1] F. MARQUES, Polytechnic University of Catalonia, J.M. LOPEZ, Arizona State University, J. ABSHAGEN, G. PFISTER, University of Kiel — A combined experimental and numerical study finds a complex mechanism of Z2 symmetry breaking involving global bifurcations. In addition to symmetry breaking via pitchfork bifurcation, the Z2 symmetry of a rotating wave that occurs in Taylor-Couette flow is broken by a global saddle-node-infinite-period (SNIP) bifurcation after it has undergone a Neimark-Sacker bifurcation to a Z2-symmetric modulated rotating wave. Unexpected complexity in the bifurcation structure arises as the curves of cyclic pitchfork, Neimark-Sacker, and SNIP bifurcations are traced towards their apparent merging point. The complex mechanism of Z2 symmetry breaking involves nonsymmetric two-tori undergoing saddle-loop homoclinic bifurcations in the vicinity of this global bifurcation. As the Reynolds number is increased beyond the SNIP bifurcation, the transition involves period-doubling cascades, period-adding cascades, and a blue-sky catastrophe. The excellent agreement between the experiments and the numerical simulations demonstrates the robustness of these exotic bifurcations in a physically realized system.

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