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Nonlinear wall modes in rapidly rotating Rayleigh-Benard convection GEOFFREY VASIL, Univ of Sydney, JEFFREY OISHI, Bates College , KEATON BURNS, MIT, KEITH JULIEN, University of Colorado — Wall-localised dynamics has seen a recent upsurge in interest in the geophysical fluids community. For example, recent work from condensed-matter physics has highlighted how well-known robust geophysical waves are direct analogues behaviours found in exotic quantum materials; e.g., topological insulators that only conduct current on their boundary. Also, for example, numerous laboratory experiments of thermal convection show definite signatures of wall instabilities, which can confound heat-flux measurements and interact with magnetism when present. This talk will present new simulation results and theoretical understanding of wall-mode convection in a regime without the bulk convection. We speculate that the vigorous wall dynamics are nonlinearly unstable analogues of topologically protected waves. Even so, we find that with sufficient thermal driving, wall modes can undergo secondary instabilities to semi-turbulent puffs that can seed an ostensibly stable interior. Theoretically, we explain how wall instability differs from traditionally understood notions of buoyancy-driven dynamics in a rapidly rotating system.

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