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Instabilities of the sidewall boundary layer in a rapidly rotating split cylinder[1] PALOMA GUTIERREZ-CASTILLO, JUAN LOPEZ, Arizona State Univ — The flow in a rapidly rotating cylinder is studied numerically. The cylinder is split in two with the top rotating slightly faster than the half. The interior basic state is in solid-body rotation with the mean rotation rate. Differential rotation drives boundary layers on the sidewall, and the top and bottom endwalls drive fluid into the sidewall layer. The basic state loses stability to three-dimensional perturbations when both the mean rotation and differential rotation increase. Then, the sidewall boundary layer and the corner flow in the slower half undergo a number of instabilities. These include slow low-azimuthal-wavenumber modes whose frequencies excite inertial waves in the interior as well as fast high-azimuthal-wavenumber modes whose impact is contained in the sidewall boundary layer region. Some of these high azimuthal-wavenumber modes have a complicated behavior with pairs of Gortler vortices present in the bottom corner of the cylinder. The behavior becomes even more complicated with mixed modes with interacting low and high azimuthal wavenumbers, and nonlinear competition due to Eckhaus instabilities and mode interactions.

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