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MHD simulations of the parametric decay of large-amplitude Alfven waves in the expanding solar wind

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The nonlinear evolution and parametric decay of large-amplitude Alfven are investigated by performing two-dimensional, compressible MHD simulations within the expanding box model, to mimic the waves propagation in the solar wind plasma. The linear and nonlinear phases of the parametric decay instability are studied for both circularly polarized waves in parallel propagation and for arc-polarized waves in oblique propagation, in the monochromatic case and in the presence of a spectrum of modes. In the oblique case, direct excitation of daughter modes transverse to the local background field is observed, and this transverse cascade seems to be favored for monochromatic mother waves. The expansion effect reduces the instability growth rate, and it can even suppress its onset for the lowest frequency modes considered here, possibly explaining the persistence of these outgoing waves in the solar wind.