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Electron-ion instability coupling in Alfvén waves propagating in high beta plasmas[1] JAMES JUNO, JASON TENBARGE, University of Maryland College Park, AMMAR HAKIM, Princeton Plasma Physics Lab, WILLIAM DORLAND, University of Maryland College Park — Recently, it was demonstrated there is a stringent amplitude limit on Alfvén waves in high beta plasmas due to the Alfvén wave destabilizing itself via the proton parallel firehose instability [1]. Here, we present extensions to this work by performing simulations of Alfvén waves in high beta plasmas with more robust models: a ten moment two fluid model, and a multi-species Vlasov-Maxwell solver. The presence of an electron model which can also develop anisotropy and agyrotropy permits the electron species to assist in destabilizing the Alfvén wave, in this case, via the electron parallel firehose instability. The presence of the electron parallel firehose provides an interesting nonlocal coupling between electron and proton scales. Since fluctuations from the electron parallel firehose instability are left handed and have real frequency comparable to the ion cyclotron frequency if the proton to electron temperature is order 1, the electron parallel firehose instability also heats the protons in our system. We also demonstrate how this phenomenon is affected by the presence of other instabilities by performing similar simulations in 2D, where oblique firehose, mirror, and whistler anisotropy instabilities can manifest.
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