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I, Alexander Philip Kofi Prokopyszyn, do hereby certify that this thesis, submitted for the degree of PhD, which is approximately 30,000 words in length, has been written by me, and that it is the record of work carried out by me, or principally by myself in collaboration with others as acknowledged, and that it has not been submitted in any previous application for any degree. I confirm that any appendices included in my thesis contain only material permitted by the 'Assessment of Postgraduate Research Students' policy.

I was admitted as a research student at the University of St Andrews in September 2017.

I received funding from an organisation or institution and have acknowledged the funder(s) in the full text of my thesis.

Date: 08/03/2021 Signature of candidate: A. Prokopyszyn

## Supervisor's declaration

I hereby certify that the candidate has fulfilled the conditions of the Resolution and Regulations appropriate for the degree of PhD in the University of St Andrews and that the candidate is qualified to submit this thesis in application for that degree. I confirm that any appendices included in the thesis contain only material permitted by the 'Assessment of Postgraduate Research Students' policy.

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I, Alexander Philip Kofi Prokopyszyn, hereby certify that no requirements to deposit original research data or digital outputs apply to this thesis and that, where appropriate, secondary data used have been referenced in the full text of my thesis.

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## Publications

This thesis contains work which has been adapted from the following publications:

1. Prokopyszyn, A. P. K., A. W. Hood, and Ineke De Moortel. “Phase mixing of nonlinear Alfvén waves.” *Astronomy & Astrophysics* 624 (2019): A90.
2. Prokopyszyn, A. P. K., and A. W. Hood. “Investigating the damping rate of phase-mixed Alfvén waves.” *Astronomy & Astrophysics* 632 (2019): A93.
3. Prokopyszyn, A. P. K., A. N. Wright, and A. W. Hood. “Line-tied boundary conditions can cause resonant absorption models to generate unphysically large boundary layers.” *The Astrophysical Journal (in prep)*.

## Collaboration statement

The numerical simulations presented in this thesis were carried out by myself under the supervision of Prof. Alan Hood, Prof Ineke De Moortel and Dr Andrew Wright.

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