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Dynamic ionization feedback in non-linear, partially ionized plasma simulations. ALASDAIR WILSON, DECLAN DIVER, University of Glasgow — We present results from numerical simulations of partially ionized plasmas using a non-linear finite difference Gas-MHD Interactions Code (GMIC), capable of utilising GPU accelerators. We incorporate the physics of Alfven ionization along with elastic and inelastic moment coupling and thermal recombination to show behaviour which manifest in a two-fluid treatment of a partially ionized plasma that are not present when either species is considered separately. All such plasmas show a hybrid response to wave propagation and plasmas in a critical regime are shown to be somewhat resistant to recombination, with up to 25% of a rapid recombination event being undone by self-induced flows. In addition, by considering a dynamic 3-dimensional atmosphere representing a tidally locked gas giant an equilibrium background ionization fraction much higher than estimated by e.g. Saha can be obtained. This method has allowed a dynamic calculation of the ionization fraction of a Hot Jupiter style gas giant to reach 10^{-4} in some regions of the atmosphere, this ionization fraction is sufficient for coupling of the magnetic field to the fluid.

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