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Magneto-Hydrodynamical Effects On Nuclear Deflagration Fronts In Type Ia Supernovae[1] BOYAN HRISTOV, Department of Physics, Florida A&M University, DAVID COLLINS, PETER HOEFLICH, Department of Physics, Florida State University, CHARLES WEATHERFORD, Department of Physics, Florida A&M University, TIARA DIAMOND, NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA, ALEC FISHER, Department of Physics, Florida State University — We presents the study of the effects of magnetic fields on non-distributed nuclear burning fronts as a possible solution to a fundamental problem for the thermonuclear explosion of a Chandrasekhar mass white dwarf (WD), the currently favored scenario for the majority of Type Ia SNe. All existing 3D hydrodynamical simulations predict strong global mixing of the burning products due to Rayleigh-Taylor instabilities (RTI), which is in contradiction with observations. As a first step and to study the flame physics we use a set of computational MHD models in rectangular flux tubes, resembling a small inner region of a WD. We consider initial magnetic fields up to 1E12 G of various orientation. We find an increasing suppression of RTI starting at about 1E9 G. The front speed tends to decrease with increasing magnitude up to about 1E11 G. For even higher fields new small scale finger-like structures develop, which increase the burning speed by a factor of 3 to 5 above the field-free RTI-dominated model. We suggest that the new instability may provide sufficiently accelerated energy production during the distributed burning regime to go over the Chapman-Jougey limit and trigger a detonation.

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