## HYDRODYNAMIC MODELS OF THE ACCRETION STREAM IN MAGNETIC CATACLYSMIC VARIABLES

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Here I use the MHD code, FLASH, from the University of Chicago ASCI Center for Astrophysical Thermonuclear Flashes, to simulate initial two-dimensional simple models of accretion streams in magnetic CVs. These models explore the evolution of inflowing material for two white dwarf masses;  $0.5M_{\odot}$  and  $0.9M_{\odot}$ . It is seen that a discontinuity forms at a height of  $6.1 \times 10^8$  cm above the white dwarf 'surface' for  $M_{\rm WD} = 0.5M_{\odot}$  and at  $1.6 \times 10^9$ cm for  $M_{\rm WD} = 0.9M_{\odot}$ . These models will be developed further with the ultimate goal of completing a three-dimensional model of magnetic accretion onto a WD surface.

The Models: Models using different white dwarf masses were constructed. For each model, a 2D cartesian grid of width  $4 \times 10^7$  cm and height  $5 \times 10^9$ cm was used. An accretion stream of this width roughly corresponds to a fractional accretion area of f = 0.001 on the surface of a  $0.9M_{\odot}$  white dwarf. The computational grid is set up so that one computational block is  $2 \times 10^7$  cm on a side and three levels of adaptive mesh refinement (AMR) are allowed during the computation. Protons and electrons are used for the stream composition, the material is allowed to radiate, and a gamma-law EOS and plane parallel gravity are employed. The entire computational volume is given the initial stream parameters T = 50,000 K and  $\rho = 1 \times 10^{-10}$  g cm<sup>-3</sup>. A downward velocity of  $-3 \times 10^5$  cm s<sup>-1</sup> is given to material above  $y = 3 \times 10^9$  cm. Each model uses a 1 MG magnetic field.

Model 1. This simulation was performed for  $M_{\rm WD} = 0.5 M_{\odot}$  (log g = 7.86). Figure 1 displays the temperature profile at times t = 0 and t = 69 s. This is the time at which a discontinuity forms at  $y = 6.1 \times 10^8$  cm, as can be seen in the plot. After time t = 69 s. a numerically seeded instability develops.

Model 2. This simulation was performed for  $M_{\rm WD} = 0.9 M_{\odot}$  (log g = 8.49). Figure 2 displays the temperature profile at times t = 0 and t = 42.5 s. This is the time at which a discontinuity forms at

Log10 lemperature (K)

Fig. 1. Temperature profile for Model 1 ( $M_{\rm WD} = 0.5 M_{\odot}$ ).



Fig. 2. Temperature profile for Model 2 ( $M_{\rm WD} = 0.9M_{\odot}$ ).

 $y = 1.6 \times 10^9$  cm, as can be seen in the plot. After time t = 42 s, a numerically seeded instability develops.

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