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The Modelling of Accretion Driven Plasma Instabilities in the Accretion Columns of Polars Using PLUTO

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This project explores the complex emission patterns and instabilities in the post-shock accretion columns (PSACs) of magnetic cataclysmic variables (mCVs). Utilizing the PLUTO code, the study integrates bremsstrahlung and cyclotron radiation mechanisms to simulate these phenomena under various initial conditions, such as white dwarf mass and magnetic field strengths. The findings reveal significant emission variability driven by shock dynamics, with bremsstrahlung dominating in high-density regions and cyclotron emission in temperature-sensitive areas. This research enhances the theoretical understanding of radiative processes in mCVs and demonstrates the effectiveness of high-resolution magnetohydrodynamic simulations in interpreting complex observational data. Future work aims to extend these simulations to three dimensions and incorporate dynamic accretion rates for more accurate modeling of high-energy astrophysical sources.

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