Mechanism for Flow Generation/Acceleration in Dense Degenerate Stellar Atmospheres

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The mechanism for flow generation in dense degenerate stellar atmospheres is suggested when the electron gas is degenerate and ions are assumed to be classical. It is shown, that there is a catastrophe in such system—fast flows are generated due to magneto-fluid coupling near the surface. Distance over which acceleration appears is determined by the strength of gravity and degeneracy parameter. Application of this mechanism for White Dwarfs' atmospheres is examined and appropriate physical parameter range for flow generation/acceleration is found; possibility of the super-Alfvénic flow generation is shown; the simultaneous possibility of flow acceleration and magnetic field amplification for specific boundary conditions is explored; in some cases initial background flow can be accelerated 100 and more times leading to transient jet formation while the Magnetic field amplification is less strong.

In present manuscript we extended the studies of recent papers [1,2] and, based on the systematic simulation experiments, showed that the degeneracy effects are significant for specific class of dense stellar atmospheres/outer layers dynamics, specifically, for the structure formation phenomena there—we suggest that when studying the evolution of the compact objects, flow effects cannot be ignored since their catastrophic generation close to the surface may determine the further evolution of stars and their atmospheres.

References

[1] V. I. Berezhiani, N. L. Shatashvili, S. M. Mahajan, Phys. Plasmas **22**, 022902 (2015).

[2] N. l. Shatashvili, S. M. Mahajan, V. I. Berezhiani, Astrophys. Space Sci. **361**, 70 (2016).