Non-equilibrium Thermodynamics of Glassy Systems[1] PYIE AUNG, Hiram College, GUJRATI PURU, University of Akron, NSF-REU TEAM[2] — When a linear amorphous polymer is in the glassy state, equilibrium thermodynamics theory is no longer consistent, for, a glass cannot be described by equilibrium statistical mechanics. Therefore, a non-equilibrium thermodynamics approach has been developed, which we intend to apply to glasses. The approach starts from the most general law of nature, the second law of thermodynamics, and shows correction terms that are missing in the conventional non-equilibrium thermodynamics of de Donder and Prigogine. We have applied this new approach and have discovered the generalization of (equilibrium) Maxwell's relations to non-equilibrium states. The generalization replaces simple partial derivatives by Jacobians' Matrices. The non-equilibrium Maxwell's relations lead to one the most paradoxical equations, the Prigogine-Defay ratio. The goal of this research is to understand non-equilibrium states with an emphasis on glasses and to solve the Prigogine-Defay ratio paradox with deeper definitions.

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