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Relativistic Plasma Screening Effects on Pulsational Pair-Instability Supernova: Astornomoical Observables and the Black Hole Mass Gap

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If an astrophysical environment is hot enough, screening in the associated nuclear reactions can be modified by the presence of a relativistic electron-positron plasma. Additionally, strong magnetic fields can create an additional enhancement as the electron and positron energy distribution is modified by the altered Landau level occupancy. This can result in a further enhancement of nuclear reaction rates, and the reaction rate enhancement factor is studied in several relevant scenarios. Nearly every astrophysical site may undergo shifts in nuclear reaction rates due to electron-positron screening at high temperatures and magnetic fields. Massive stars that undergo pulsational pair-instability can be affected by the relativistic plasma in the core, and results are presented including affects on the final black-hole mass, composition of matter ejected in the pulse, and stellar dynamical effects. Brief mention is made of the effects of relativistic screening and screening in highly magnetized plasmas on other astrophysical sites.

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