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White dwarf stars exceeding the Chandrasekhar mass limit

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### Highlights

A nearly degenerate electron plasma pervading an ionized high-density background medium is studied, as it occurs in stellar matter.

The Dirac equation coupled to the permeability tensor of the medium leads to nonlinear electron dispersion in the ultra-relativistic regime.

The quantized spectral density of a low-temperature electron gas in a dispersive medium is shown to be mechanically and thermally stable.

The nonlinear electron dispersion affects the mass-radius relation of white dwarfs, whose mass can surpass the Chandrasekhar limit.

White dwarf progenitors of super-Chandrasekhar mass Type Ia supernovae: estimates of their central mass density, incompressibility and speed of sound.

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