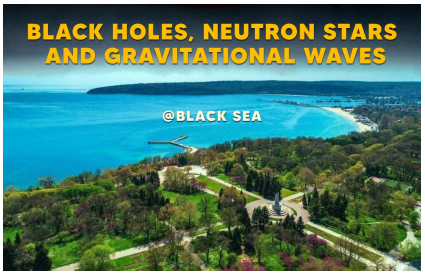

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Torsional four-fermion interaction and the Raychaudhuri equation

The intrinsic spin of fermions can generate torsion in spacetime. This gives rise to an effective four-fermion interaction that fermions experience within a fermionic distribution. This interaction is expected to become significant when densities become large, such as in early universe cosmology or in compact astrophysical objects like neutron stars. In this contribution, I will discuss the role of this interaction in a gravitationally collapsing fermionic distribution. Our specific aim is to explore if this interaction can provide a repulsive contribution and prevent the formation of the final singularity. We consider a collapsing distribution of fermions which incorporates both chiralities. We use the Raychaudhuri equation and the focusing condition for congruences to carry out our investigation. Using reasonable assumptions, we establish that a repulsive contribution arises depending on how torsion couples with different chiralities. Also, the interaction term will behave analogous to an exotic matter (dark matter) component, having an effective negative equation of state, and the effect of the interaction starts to dominate as the collapse proceeds, accelerating or decelerating the collapse depending on the relative signs of the geometrical interaction between different species of fermions.

This work contributes to the understanding of how torsion-driven effects in dense fermionic systems might resolve the final singularity formation, and may have implications for the end-states of stars, such as neutron stars or other dense astrophysical objects.

Author: Mr MAITY, Sagar Kumar (S N Bose National Center for Basic Science)

Co-authors: Prof. LAHIRI, Amitabha (S N Bose National Center for Basic Science); Dr GUPTA CHOUDHURY, Shibendu (Centre For Theoretical Physics, Jamia Millia Islamia)

Presenter: Mr MAITY, Sagar Kumar (S N Bose National Center for Basic Science)