

Exciton mechanism explains experimental discrepancies of warm dense hydrogen metallization measurements

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Insulator-to-metal transition (IMT) in fluid warm dense hydrogen (WDH) is one of the unresolved problems of the last decades. There are a large number of experiments aimed at determining thermodynamic states of this transition, but they have a large number of disagreements.

This work is the result of a rethinking of theoretical works and a search for the cause of the current disagreement between the results of theory and experiment. We go beyond the FT DFT approximation and take into account the possibility of non-adiabatic energy transfer from ionic vibrations to electron excitations [1]. In this case, we have obtained the effect of the formation and dissociation of excitons in the region of the observed absorption that is associated with the phase transition [2].

The resulting mechanism allows us to explain the current disagreements between static and dynamic experiments and provides a new physics picture of the transition.

[1] Fedorov I D, Orekhov N D and Stegailov V V 2020 *Phys. Rev. B* **101** 100101

[2] Fedorov I and Stegailov V 2021 *JETP Letters* **113** 396–401