

demonstrates that in regimes (a) and (b) characterized by relatively low magnetic fields, the magnetic field's influence is mediated via the streaming ions, resulting in a faster-than-classical dependence of the diffusion coefficient on the magnetic field strength.

**In Chapter 5**, the shear viscosity ( $\eta$ ) of a three-dimensional liquid dusty plasma was estimated as a function of magnetic field strength ( $B$ ) and normalized ion flow velocity ( $M$ ) based on simulation data. The estimation was conducted using Langevin dynamics simulations and the Green-Kubo formalism. In the presence of ion drift, an oscillatory and attractive wake potential develops among charged dust particles, as discussed in the earlier chapters. The amplitude of this wake potential can be modulated by applying an external magnetic field. In this study, we investigated how the shear viscosity of complex plasma is influenced by an external magnetic field via the anisotropic wake potential. The rheological characteristics of such plasma are dependent on the dominant interactions among the particles and can be controlled by applying an external magnetic field.

**In Chapter 6**, a thorough examination of the results presented throughout the thesis is conducted, offering valuable insights into the research findings. Additionally, the chapter elucidates the exciting prospects and directions for future studies in the field.

**Key words:** Plasma, Dusty plasma, Wakefield oscillations, Molecular Dynamics Simulation, Green-Kubo Formalism, Wake potential, Self-diffusion, Rheological behavior, Fluid equations, Strongly coupled dusty plasmas, Interaction mechanism, Plasma state of soft matter, Fluctuation-Dissipation Theorem, Langevin equation.

## Declaration by Candidate

I, **Biswajit Dutta**, declare that the thesis entitled “**A comprehensive study on interaction mechanism, transport coefficient and rheological behaviour of complex plasma in magnetized flowing environment**” is a record of my own work carried out under the supervision of **Dr. Nilakshi Das**. I, hereby, confirm that:

- This work was done wholly or mainly while in candidature for a research degree in Doctor of Philosophy at Tezpur University. Where no part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work. I have acknowledged all main sources of help.
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## Certificate by the Supervisor

This is to certify that the thesis entitled “**A comprehensive study on interaction mechanism, transport coefficient and rheological behaviour of complex plasma in magnetized flowing environment**”, submitted to the School of Sciences, Tezpur University in partial fulfillment of the requirements for the award of the degree of **Doctor of Philosophy in Physics** is a record of original research work carried out by **Mr. Biswajit Dutta** under my supervision and guidance.

All help received by him from various sources has been duly acknowledged.

No part of the thesis has been submitted elsewhere for the award of any other degree.

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