

# Structure and dynamics of dusty plasma in the range $9 - 150 K$ : analysis of experimental data

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We present an analysis of the structural and dynamic properties of a dust cloud in a helium glow discharge at cryogenic and higher temperatures. The base experimental data are kindly provided by the authors of [1]. A method for identifying three-dimensional dust structures using the pair correlation function with only two-dimensional coordinates is verified via numerical simulation. It is applicable when the width of the illuminating laser beam exceeds several interparticle distances. The influence of discharge parameters on the resulting structure type is analyzed. In particular, disordering of the dust cloud due to current increase is compared with experimental data for dusty plasma in neon [2]. Neural network-based particle tracking velocimetry reveals that the particle velocity distribution deviates significantly from a Maxwellian distribution. This deviation shows a notable similarity to the behavior of active Janus particles [3], suggesting a shared non-equilibrium dynamics. This positions dusty plasma in this regime as a possible active matter system.

- [1] Samoylov I S, Baev V P, Timofeev A V, Amirov R K, Kirillin A V, Nikolaev V S and Bedran Z V 2017 *JETP* **124** 496–504
- [2] Polyakov D N, Shumova V V and Vasilyak L M 2018 *Journal of Physics: Conference Series* **1058** 012029
- [3] Nosenko V, Luoni F, Kaouk A, Rubin-Zuzic M and Thomas H 2020 *Phys. Rev. Res.* **2**(3) 033226