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**Machine-learning Analysis of the Structure of a Dust Cloud trapped in DC Plasmas**[1] KE QIAO, JORGE CARMONA, ZHIYUE DING, MIKE COOK, KENNETH ULIBARRY, JIE KONG, LORIN MATTHEWS, TRUELL HYDE, Baylor University — In the PK-4 dusty plasma experiment onboard the International Space Station (ISS), the dust cloud can form unique structures, such as multiple chains along the direction of the DC electric field. An identical experimental setup on earth (PK-4 BU) provides the ability to manipulate and investigate these structures under similar experimental conditions, but under the influence of gravity. In this research, the 3D structure of dust clouds formed in the PK-4 BU is investigated where dust clouds are trapped by rapidly switching the polarity of the DC electric field. Vertical slices of the trapped cloud are imaged by scanning a vertically-fanned laser beam with a width of $\approx 150$ $\mu$m. The 3D structure of the clouds is then reproduced from the two-dimensional (2D) pictures obtained from the scan. In this manner, crystallization as well as phase transitions of the 3D dust cloud can be recognized and analyzed using a machine learning based approach. These results will be compared to data from the PK-4 ISS as well as to simulations of dust structures in environments similar to those found in the experiments. Dispersion relations obtained from the dust particle motion will be used to probe the inter-chain interactions.

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