Dust particles and plasma glow as diagnostics for the sheath region in complex plasma

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Dust levitation is essentially one of the boundary effects in plasma discharges. Only strong electric fields in regions in front of surfaces allow charged micrometer sized dust particles to be levitated against gravity. The force acting on such particles has a complex profile, even when ion drag and ion-wake effects are not considered, as illustrated in figure 1. This profile depends on the local plasma parameters, both through the build-up of the sheath region and the corresponding electric field, as well as through the charging of the dust by collection of plasma particles. It has been shown that electron depletion and ion acceleration have a large impact on shaping this profile [1] and the levitation of dust particles with different sizes [2]. On the other hand, local changes in plasma parameters just above and within the sheath cause a large change in the plasma emission, which is why the dark region in front of surfaces is usually identified with the sheath. Figure 2 shows a typical horizontally averaged, vertical emission profile above such a surface [3]. Interestingly enough, it shows a lot of similarity to the force profile in figure 1. In this presentation, we focus on the force profile and the emission profile using data from different experiments and numerical simulations. The ultimate goal is to characterize the force profile just by using the emission profile. This could help to untangle the ever-present requirement of finding both the charge and the electric field profile simultaneously in order to describe the levitation of dust in complex plasma experiments.