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Distribution and Dynamics of Dusty Plasma in Saturn's Plasma Disk

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Earlier reported observations by the Radio and Plasma Wave Science (RPWS), including interferometry of plasma density inhomogenities (δn/n), has revealed that the plasma disk surrounding the E-ring of Saturn consist of two ion populations; one nearly co-rotating with the planetary magnetic field an another moving with near Keplerian speed around Saturn. The Keplerian population consist of colder ions, which are trapped around negatively charged E-ring dust grains. The charged dust interacts collectively with the dense surrounding plasma and inhibits $\mathbf{E}\times\mathbf{B}$ pick-up. Even so some ions are heated to energies above the dust-potentials and become part of a hotter co-rotating ion population. The heating can be the result of simultaneously detected low frequency broadband emissions probably of the ion-acoustic type. Here we report a study based on Langmuir probe (LP) data from several orbits with E-ring plane crossings, from which it is possible to map the distribution and relative fraction of the ion populations within the plasma disk. We also report the detailed observations from some ring-plane crossings, where we compare the dust distributions with the behaviour of the cold plasma disk. We show that a substantial fraction of the total negative charge can be situated on the E-ring dust population.