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The conductive dusty ionosphere of Saturn

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Cassini's Grand Finale orbits brought us historical first in-situ measurements of Saturn's ionosphere, showing that it contains dusty plasma in the equatorial region. We present the Pedersen and Hall conductivities of the top ionosphere (10:50 – 12:17 Saturn Local Time, 10N – 20S planetocentric latitude), derived from particle and magnetometer data. We constrain the Pedersen conductivities to be at least 10^{-5} – 10^{-4} S/m at ionospheric peak, a factor 10-100 higher than estimated previously by remote measurements, while the Hall conductivities are very close to 0 or in fact negative. We show that this is an effect of dusty plasma. Another effect is that ionospheric dynamo region thickness is increased to 300-800 km. Furthermore, our results suggest a temporal variation (decrease) of the plasma densities, mean ion masses and consequently the conductivities over the period of one month.