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A model of the neutral and plasma tori around Saturn's A and B rings

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Plasma measurements during Cassini's orbit insertion on July 1, 2004 revealed the presence of an ionosphere above the A and B rings with $O_2{}^+$ and O^+ as major ions, suggesting the existence of a toroidal atmosphere made up of molecular oxygen. It is likely produced by radiation-induced decomposition of ice releasing both H_2 and O_2 molecules which do not stick on the surface at the relevant temperatures (80-100°K). Here, we present results of a study based on a hybrid model of the neutral and plasma tori that uses a test-particle approach for ions and neutrals. The model makes use of Monte Carlo techniques and takes into account chemical processes that lead to plasma creation such as photo-ionization and charge exchange. Key features of the plasma transport along Saturn's corotating magnetic field lines include the impact/transmission probability for plasma particles to pass through the rings, taking into account the electrostatic charging of ring particles, and the ambipolar electric field, which preserves electric neutrality above the ring plane. We will account for escape of oxygen and hydrogen from the ring system and chemical recombination of the ring particle surfaces. Published plasma data from CAPS are used as constraints or inputs to the model.