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A comet's tale: Role of charge exchange in the plasma environment of comet 67P/Churyumov-Gerasimenko

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On 6 Aug. 2014, the Rosetta mission arrived in the vicinity of comet 67P/Churyumov-Gerasimenko (C-G) and started measuring its complex plasma environment, using notably the RPC-ICA ion spectrometer (Rosetta Plasma Consortium Ion Composition Analyser). A simple model of charge-exchange processes is first presented for He^{2+} and H^+ solar wind ions that efficiently convert them into He^+ ions (measured by RPC-ICA) and H energetic neutral atoms, respectively. In a second step, we present a new cometary hybrid plasma model, taking into account photoionisation, charge-exchange, electron impact ionisation and electron recombination, dedicated to the interpretation of RPC-ICA measurements. We use this global model to investigate in more detail the role of the water production rate and charge-exchange processes in the formation of plasma regions at comet 67P/C-G and for various heliocentric distances.