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Experimental and numerical investigation of an iodine plasma FLORIAN MARMUSE, BENJAMIN ESTEVES, CYRIL DRAG, JEAN-PAUL BOOTH, ANNE BOURDONE, PASCAL CHABERT, Laboratoire de Physique des Plasmas — Iodine is an alternative propellant for the electric propulsion of satellites, for which models and dedicated diagnostics are scarce. In this work, tools and processes are developed to ensure the safety of operators and experimental setups during iodine experiments. Four optical diagnostics are developed and installed on the ionization chamber of the PEGASES thruster. They lead for the first time to the density and temperature of I, and the density of I2: emission spectroscopy, laser absorption coupled to Doppler-free saturated absorption spectroscopy at 10969 and 11036, laser absorption spectroscopy at 7603cm-1, and broadband absorption spectroscopy from 480nm to 500nm. Langmuir probe measurements yield the electron density and temperature, and their spatial evolution in the plasma. Confronting this data to a global model shows that the model overestimates the molecular dissociation and the electron density. These discrepancies are shown to be partly explained by underestimated power losses phenomena in the plasma, possibly linked to its molecular and electronegative nature. This work gives leads for future theoretical work and diagnostics on I2 plasmas. It proposes an updated model and a set of new diagnostics for use to further develop iodine-based propulsion systems.

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