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Physics and modeling of ID-HALL, a new concept of double stage HALL thruster JEAN-PIERRE BOEUF, LOIC DUBOIS, ALEXANDRE GUGLIELMI, FREDDY GABORIAU, LAURENT LIARD, University P. Sabatier — HALL thrusters are EXB plasma devices where a large electric field can be generated in a quasineutral plasma by applying a DC voltage across a magnetic barrier. This electric field allows electron impact ionization of a flux of atoms injected at the anode, and accelerates ions out of the plasma, generating the thrust. In a double stage HALL thruster (DSHT), the plasma is generated in a plasma source independently of the applied voltage, allowing separate control of thrust and ion velocity. A new DSHT design, ID-HALL (Inductive Double-stage HALL thruster), is described. An RF inductive coil is placed inside the inner cylinder of ID-HALL. Thanks to a magnetic field distribution that efficiently connects the cusps of the plasma source to the magnetic barrier, a high density magnetically confined toroidal plasma is formed around the inner cylinder, close to the accelerating field of the magnetic barrier. After a brief discussion of the DSHT concept, we present 2D simulations of ID-HALL performed with the HALLIS hybrid model (https://www.hallis-model.com). Plasma density, electron temperature and properties of the extracted ion beam as well as the performance of the thruster are studied as a function of DC voltage, RF power and gas mass flow rate.

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