Abstract Submitted
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Electronic and Positronic Guiding Center Ions[1] DAN DUBIN, UCSD — A novel type of guiding center drift ion is described. These ions only occur in strong magnetic fields. They consist of a neutral atom to which either an electron or a positron is weakly bound, at sufficiently large radius that it may be described by $\mathbf{E}\times\mathbf{B}$ drift dynamics. The attractive electric field arises from the weak induced dipole moment of the neutral atom in the field of the outer charge. Such ions may occur naturally in astrophysical plasmas and may also have been formed in recent antihydrogen experiments, where their presence would provide proof that deeply bound $\overline{H}$ atoms are being created. Binding energies and orbital dynamics are described in two limits: (i) a ground state H atom along with an outer charge in a zero-angular-momentum orbital, and (ii) a classical guiding center drift H atom (a proton about which an electron $\mathbf{E}\times\mathbf{B}$ drifts in the Coulomb field) with an electron or positron bound at larger radius. For case (i) the affinity of a positronic H^+ ion is shown via a full quantum calculation to be $2.23(B/B_0)^2e^2/a$, where $B_0 = 2.35\times10^5$ Tesla and a is the Bohr radius. This scaling with B agrees with a recent estimate.[2] For case (ii) much larger binding energies (of order meV) are found because the induced dipole moment of a guiding center atom is much larger than that of ground state hydrogen.

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[2]V.G. Bezchastnov et al., Phys. Rev. A **61**, 052152 (2000).

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