Title

Magneto-Electrostatic Containment of Plasma Ions

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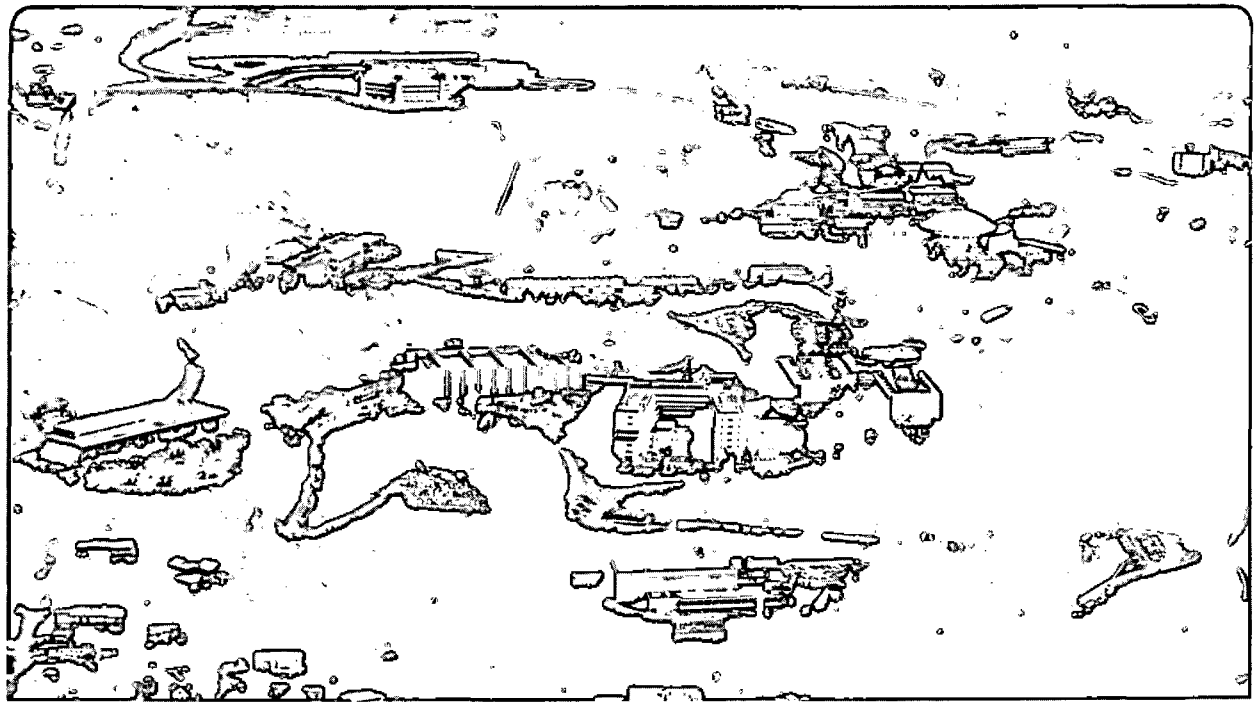

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Magneto-Electrostatic Containment of Plasma Ions

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The multi-cusp plasma source (bucket source) is capable of producing large volumes of uniform and quiescent plasma with densities exceeding 10^{12} ions/c.c. Experimental results indicate that confinement of primary ionizing electrons is responsible for most of the improvement over non-magnetically confined plasmas. The containment of ions however, is found to be much weaker. Plasmas are lost to the line cusps and to regions in-between the cusps. For massive ions such as xenon and for weaker permanent magnets, there can be a substantial plasma loss to areas in between the line-cusps. We have succeeded in reducing this ion leakage by installing thin strips of electrodes in between magnet columns as shown in Fig. 1. As the electrodes are biased positively with respect to the anode, they start to repel the positive ions and collect electrons. The electron current drawn by the electrodes saturates at approximately +10 V as shown in Fig. 2. Langmuir probe traces obtained at the center of the source with the electrodes biased at anode potential and at +10 V above anode are shown in Fig. 3. The plasma density is found to increase by 27% while the total power increased only by 9%. This technique involves no geometric perturbation to the plasma and should be useful for plasma etching, ion machining and ion inplantation purposes.

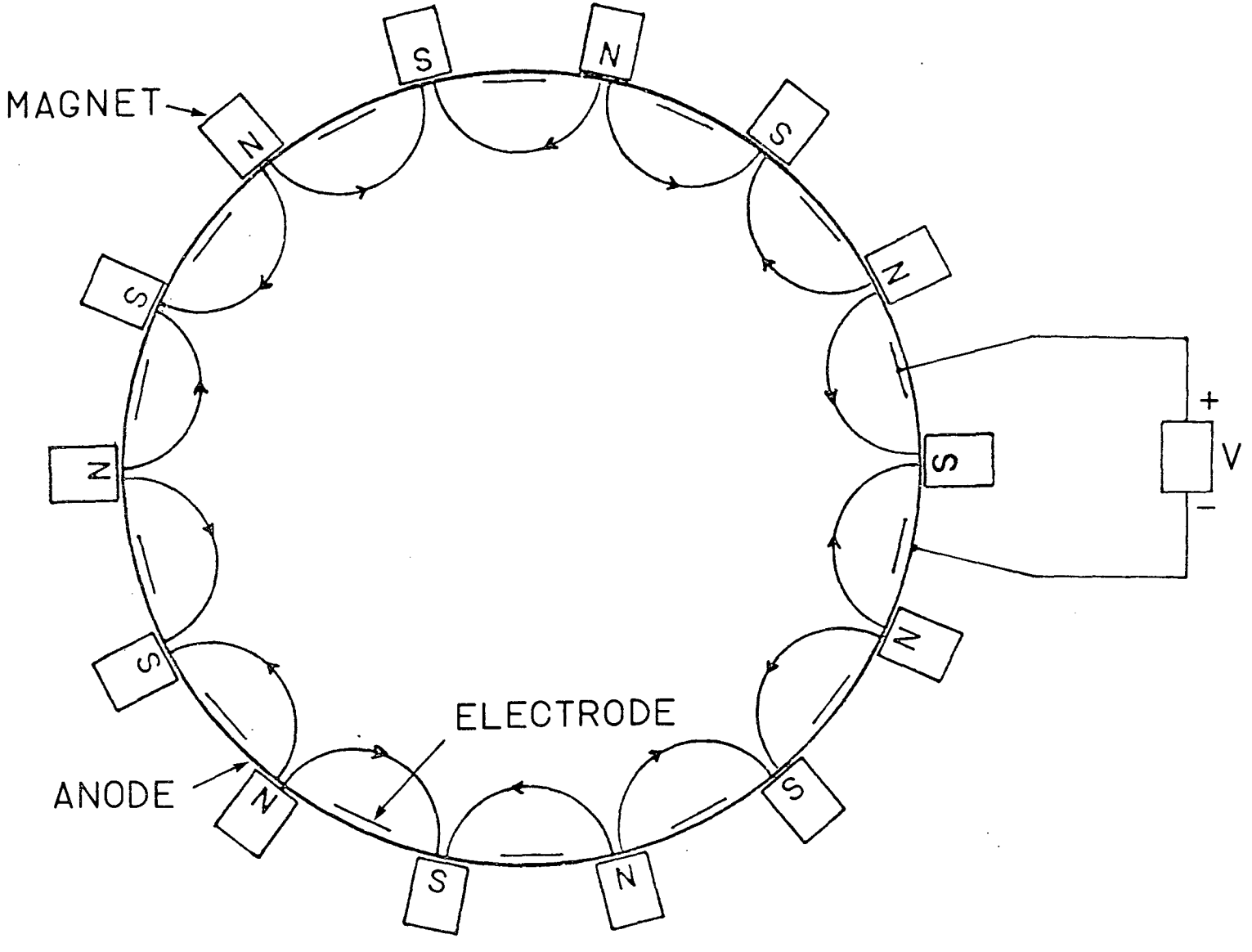

Fig. 1

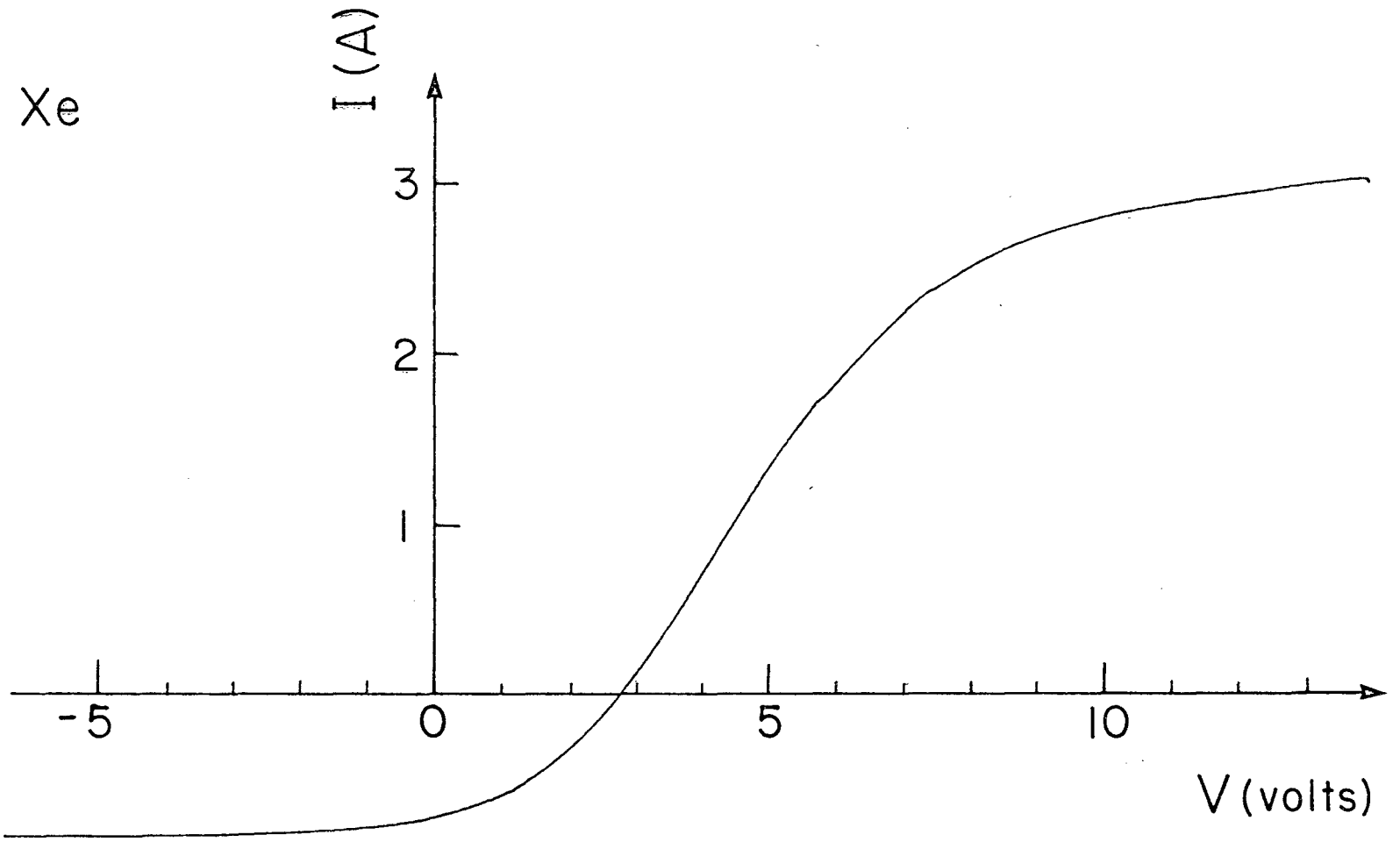

Fig. 2

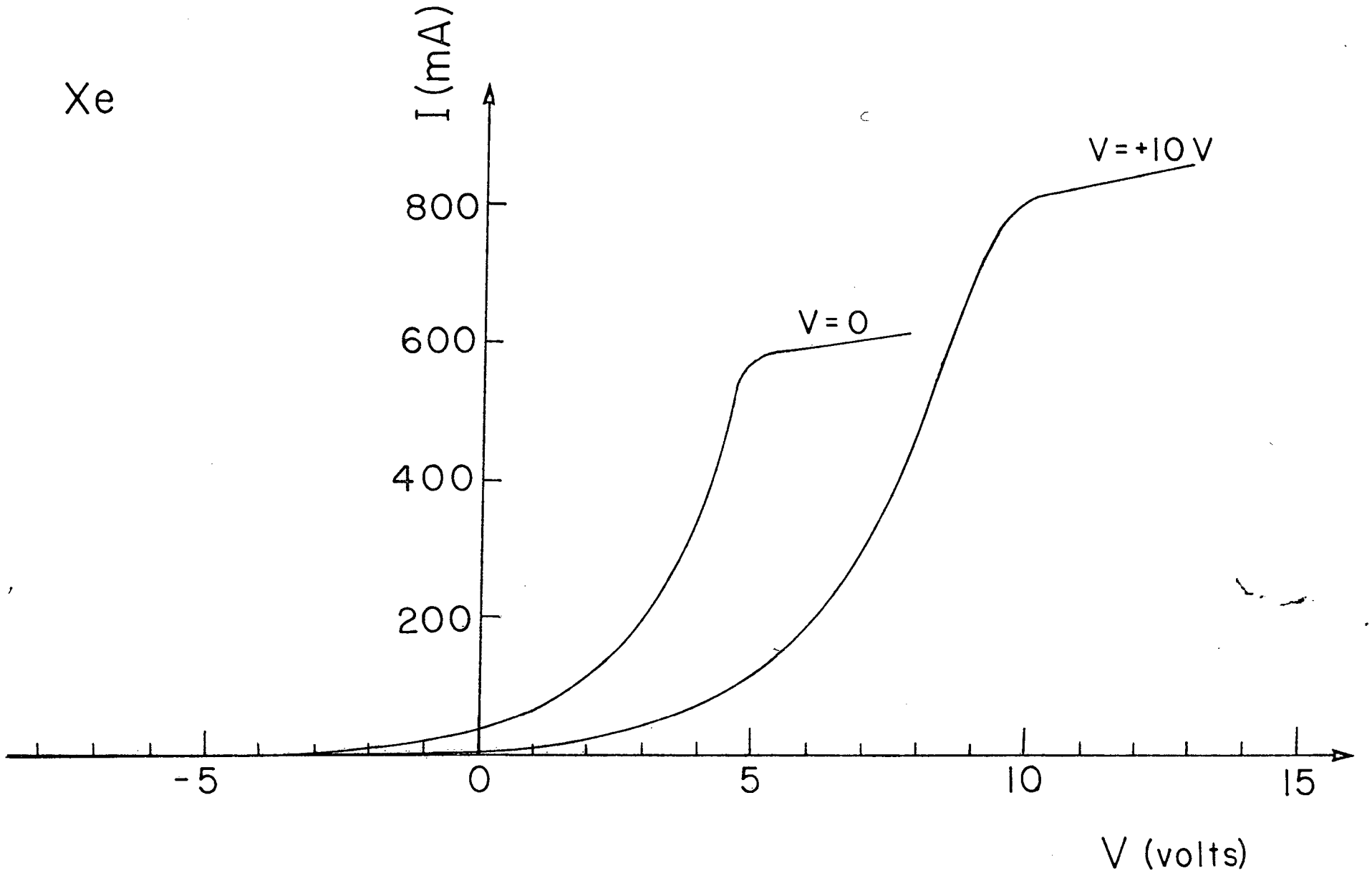

Fig. 3

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