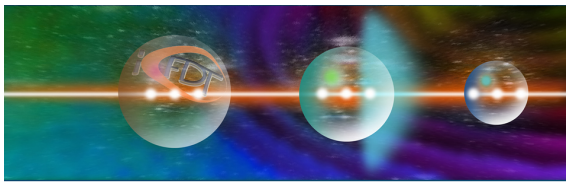

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Compact Ion Beam System for Fusion Demonstration

Tuesday, 22 October 2024 18:05 (1 hour)

We demonstrate a compact ion beam device capable of accelerating H+ and D+ ions up to 75 keV energy, onto a solid target, with sufficient beam current to study fusion reactions. The ion beam system uses a microwave driven plasma source to generate ions that are accelerated to high energy with a direct current (DC) acceleration structure. The plasma source is driven by pulsed microwaves from a solid-state radiofrequency (RF) amplifier, which is impedance matched to the plasma source chamber at the S-band frequency in the range of 2.4–2.5 GHz. The plasma chamber is held at high positive DC potential and is isolated from the impedance matching structure (at ground potential) by a dielectric-filled gap. To facilitate the use of high-energy-particle detectors near the target, the plasma chamber is biased to a high positive voltage, while the target remains grounded. A target loaded with deuterium is used to study D-D fusion and a B4C or LaB6 target is used to study p-11B fusion. Detectors include solid-state charged particle detector and a scintillation fast neutron detector. The complete ion beam system can fit on a laboratory table and is a useful tool for teaching undergraduate and graduate students about the physics of fusion.

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