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Surface Wave Discharges as Sources of "Super Hot" Hydrogen Atoms ELENA TATAROVA, EDGAR FELIZARDO, FRANCISCO DIAS, JULIO HENRIQUES, CARLOS FERREIRA, Institute of Plasmas and Nuclear Fusion, Instituto Superior Tecnico, Lisbon, BORIS GORDIETS, Lebedev Physics Institute, Moscow — Surface waves discharges are sustained by the electric field of a propagating surface wave, which creates its own propagation structure as it travels "Super hot" (with kinetic energy in the range 4 - 10 eV) and "hot" (kinetic energy ~ 0.3 eV) hydrogen atoms were detected throughout the volume of surface wave (350 MHz, 500 MHz) generated H_2 plasma columns, at pressures p = 0.01 – 0.2 mbar, from the analysis of the H_β, H_γ, $H_\delta$and H_ε emission line profiles. These line profiles were found to evolve from single Gaussian to bi-Gaussian shapes towards the plasma column end. The energy of "super hot" atoms in the discharge operating at 350 MHz is higher than that at 500 MHz. Moreover, the measured profiles change significantly along the radius. The broader base expands towards the wall, indicating that H atoms are accelerated in that region. These results provide confidence to the hypothesis that "super hot" H atoms originate from charge acceleration in the radial dc space-charge field followed by recombination with electrons at the wall and subsequent emission of fast excited atoms back into the plasma. Population inversion between the levels 5→4 and 6→4 was detected from the measured relative intensities of transitions within the Balmer series.

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