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Instabilities in magnetron plasma and electron transport

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Magnetron plasma presents common feature with other magnetized plasmas such as Hall thrusters, and in both, localized density structures – so called spokes – have been reported. Spokes are present in the direct current discharges as well as in high power impulse magnetron sputtering (HiPIMS) and they can be at the origin of the abnormal electron transport.
Recently, LPGP (Orsay) modeling team has developed a particular approach called Pseudo-3D [1] as an extension of the PIC-MCC (Particle-in-Cell Monte Carlo Collision) approach, called OHiPIC (Orsay High Density Particle-In-Cell). It models the plasma behavior in the azimuthal direction in the magnetized trap, just above the target either in DC or in HiPIMS mode. The results undoubtedly show high frequency instabilities lying in the range of MHz, in addition to centimetric space structured plasma as previous observed by other groups by fast camera, for instance.
The coherent Thompson scattering experiments performed with the Praxis diagnostic platform (ICARE) can record the electron instabilities in the plasma, and especially in the magnetized region. The measurements found the same MHz fluctuations of the electrons, compatible with the electron cyclotron drift instabilities [2].
Very recently, ICARE team has developed a complementary incoherent Thompson scattering platform THETIS (THomson scattering Experiments for low Temperature Ion Sources). Hence, for the first time was possible to measure the electron density and temperature in front (few mm) of the magnetron target, in DC and HiPIMS without disturbing the plasma.
Experimental and modeling results are in good agreement and they are compared and commented.

1. Revel, T. Minea, and S. Tsikata Phys. Plasmas 23 (2016) 100701; doi: 10.1063/1.4964480
2. Tsikata and T. Minea, Phys. Rev. Lett. 114 (2015) 185001; DOI: 10.1103/PhysRevLett.114.185001

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