Contribution ID: **3356** Type: **not specified**

P2.3014 Laser diagnostics of helium low temperature plasmas using Stark broadening

Tuesday, 9 July 2019 14:00 (2 hours)

See full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P2.3014.pdf
Atoms and ions in plasmas are suffered by collision with another particle, local electric field by electron and ion, plasma radiation, and so on. These interactions cause spectral line broadening of plasma radiation such as natural broadening, Doppler broadening, van der Waals broadening, resonance broadening, and Stark broadening [1]. Among these spectral line broadening, Stark broadening is widely used to determine the electron density of the astrophysical plasmas and the atmospheric pressure plasmas because Stark broadening is larger than Doppler broadening in those field [2,3]. In low temperature plasmas, Stark broadening is quite smaller than Doppler broadening so that Doppler broadening has to be removed to measure Stark broadening. In this research, we have constructed ICP plasma source to investigate Stark broadening in helium low temperature plasmas and we have composed of saturated absorption spectroscopy configuration using high resolution laser diode system of which linewidth was less than 1 MHz. Doppler-free absorption spectrum for 21S-41P transition of helium plasmas was measured when pressure was 20mTorr and RF power of 800 W was applied to the plasma source. As well saturation parameter was determined using the saturated absorption spectrum and laser power broadening was determined. Stark broadening was measured using the saturated absorption spectrum and the electron density of helium low temperature plasmas was determined. The determined electron temperature was compared with those by the electric probe and the collision-radiative model.

Reference
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Presenter: LEE, W. (EPS 2019)

Session Classification: Poster P2

Track Classification: LTPD