Possible means of observing non-Maxwellian distributions in divertor plasmas

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Physical Problem :

Electron heat transport along field lines is **non-classical** <u>**if**</u> the **thermal gradient is steep**.
Non-maxwellian distribution functions then exist.
Especially : surplus of fast electrons in the cold plasma (streaming from the hot part).

<u>In divertor plasmas</u>: Hot plasma at the separatrix;
Cold is near the plates
This affects : rates of ionization and excitation there,
if U or $\Delta E > 3\text{-}5\ kT_{cold}$.

e.g. ionization of D or H, in 1 eV plasma,
downstream to 25 eV plasma.

(F. Allais, this meeting, Wednesday morning)

Computational solution :

Non local methods : spatial convolutions over
classical heat flux,
rates of ionization and excitation, etc.

Gives good agreement with 1-D electron kinetic simulations, for affordable computational time.

Plans : Add full recycling physics in the model.
Go to 2D, adding perpendicular diffusion.
Implement into UEDGE
(Keeping full compatibility with present UEDGE in low gradients, Maxwellian cases)
Apply to : ELMS and disruptions,
D ice pellet injection.
Also, compute rates for impurities, (traces).

<u>How to observe this physics?</u>

If there is 1 eV plasma, look at UV H lines
(? E :10.2, …, 13.6 ev >> 1 eV)

If the divertor plasma is attached (e.g. Te ˜ 10 ev), need lines with higher ? E.
Consider impurity injection (e.g. low Z pellet injector), into the divertor.
Can look at visible lines, for bulk T_e.
For hot electrons, look at X-rays from K shell (Ka).
For C, this is E ≥ 360 eV; 90 ev for Li.
Feasability study planned.
Estimates of expected signal will be made.
Very good spatial resolution needed.

Other way: Thomson scattering in divertor.
(exist in DIII-D)