

List of changes

The (pag.) numbers refer to the original version of the manuscript reviewed by the referees.

- 1) T.E. Evans has been included as co-author, since he originally stimulated the measurement, and discussion on several aspects of the paper.
- 2) In the abstract, the sentence "*This shows for the first time in a tokamak edge plasma that a magnetic island can act as convective cell because of the particular drifts of electrons and ions in the 3D magnetic topology*" has been changed with "*This shows that, in a tokamak edge plasma, a magnetic island can act as convective cell as pointed out by previous results. Here, we show for the first time that the particular drifts of electrons and ions in a 3D magnetic topology account for these effects.*"
- 3) (pag.2) The paragraph "*They are present in all types of toroidal confinement devices [...] higher resonant mode components of the magnetic field setup*" has been reduced and reference [3] cut.
- 4) (pag.2) The sentence "*In the edge of all configurations, it has been observed that magnetic islands modulate the plasma pressure profile [8, 7, 6, 9]*" has been changed with "*In the edge of all fusion devices, it has been observed that kinetic properties of the plasma, such as electron density and temperature [R. Moyer, 2012; H. Stoschus, 2012], electron pressure [N. Vianello, 2013], connection length [Y. Feng, 2011], in presence of 3D fields and magnetic chaos in the edge, show macroscopic modulations coherently with the symmetry of the dominant magnetic island.*"
- 5) (pag.2) The sentence "*The role of E_r for the Greenwald density limit [13] was explored at RFX-mod with the ansatz that E_r was arising from the electrostatic ambipolar potential imposed by a differential radial diffusion of electrons and ions in a chaotic magnetic topology.*" has been cut.
- 6) (pag.2) The sentence "*In this Letter a comparative analysis is conducted for the first time for a tokamak with RMP fields applied.*" has been changed

with “*In this Paper we present the first algebraic determination of an ambipolar potential in a tokamak with resonant magnetic perturbation fields applied*”.

- 7) (pag.3) The sentence “*In this letter, we present for the first time evidence that a magnetic island in the plasma edge of a tokamak can generate enhanced radial particle transport by acting as a convective cell in the plasma potential causing strong $E \times B$ flow and hence a radially outward directed net transport*” has been changed with “*Previous results have pointed to the formation of island convective cells due to $E \times B$ flows around magnetic islands [Takamura Phys. Fluids 1987; McCool Nucl. Fusion 1990; Evans 14th EPS Madrid, 1987; Ida Nucl. Fusion 2004]. Here, we show for the first time that ambipolar potentials, with the same symmetry as the magnetic island, due to differential drifts of ions and electrons in islands can account for the radial electric fields responsible for these flows*”.
- 8) (pag.3) The sentence “*For this experiment the mode number resonant field $m/n = 3/1$ was used*” has been changed with “*For this experiment, performed in the L-mode wall limited circular plasmas, the mode number resonant field $m/n=3/1$ was used*”.
- 9) (pag.3) “*magnetic field lines*” changed with “*vacuum magnetic field lines*”.
- 10) (pag.3) “*ergodic*” changed with “*stochastic*”.
- 11) (pag.3) Fig.1 Y-axis radial coordinate modified consistently with Figs.3-4.
- 12) (pags.3-4) The paragraph “*In order to evaluate the particle diffusion coefficients, D , we proceed as [...] density gradients gives the local transport rate [24].*” has been reduced. We specified that the energy of the test particles, temperature and background density are chosen to reproduce collisionality in the experimental conditions. Profiles are reconstructed through the transport code EMC3-Eirene in unperturbed conditions (i.e., no RMP applied).

- 13) (pag.4) We specified that Fig.2 is adapted from Fig.6 in [Spizzo et al., Phys Plasmas 2014]. Fig.2 differs in small corrections of De .
- 14) (pag.4) The small paragraph "*Finally, it is worth noting [...] which corresponds to $Er = 0$ [26]*" has been cut.
- 15) (pag.5) "*separatrix*" changed with "*last closed flux surface*".
- 16) (pag.5) We added a picture (Fig.4) with the map of the modeled ambipolar potential to be compared with the measured plasma potential.
- 17) (pag.6) We corrected the formula $Er = d\phi/dr$ where a minus sign was missing.
- 18) (pag.6) "*separatrix*" changed with "*last closed flux surface*".
- 19) (pag.7) Added the sentences
"Even if the method is well-known since a long time, and its possible extension to a symmetry-breaking perturbation has already been mentioned elsewhere [Callen, Nucl. Fusion, 2011], this is the first time that the calculation has been fully carried on."
"Here the name for the roots follows the usual meaning given in stellarators, where "electron root" means the ambipolar root for the fastest particle involved in radial transport"
- 20) (pag.7) We added a picture (Fig.6) with a scan of De/Di at the OP and XP as a function of Te/Ti . It shows that, if $Te/Ti < 0.5$, $De/Di < 1$, which implies that ion heating would flip the system from the electron root (stable in the TEXTOR experimental conditions analyzed) to the ion-root, with the potential well at the OP instead than at the XP.
- 21) (pag.7) "*separatrix*" changed with "*last closed flux surface*".