AAPPS-DPP2020, 26-31,10.2020, Remote e-conference

AAPPS-DPP2020 Invited/Plenary Nomination Form

0. **Recommender's name, E-mail and affiliation**
   Name: W. Chen E-mail: chenw@swip.ac.cn Affiliation: Southwestern Institute of Physics
1. **Session category:** MF
   CD: Cross Disciplinary (Magnetic Reconnection), F: Fundamental plasma physics, B: Basic plasma,
   A: Applied plasma, L: Laser plasma, SG: Space&Geomag plasma, SA: Solar& Astro plasma, MF: Magnetic Fusion Plasma

Cross Disciplinary (Focused topics): Cross-disciplinary discussion on magnetic reconnection from various plasma fields.
Fundamental: All "Fundamental disciplines" common to various plasma application fields, such as plasma turbulence, MHD/Kinetic MHD and reconnection, Dynamo Theory, Gyrokinetic theory, Collisional transport, et al and Mathematical plasma physics. The Fundamental session welcomes papers on simulation and experiment which address fundamental questions in plasma physics
Basic: All common "methods" in plasma physics such as plasma diagnostics, plasma simulation, plasma sources. In this era of exascale computing, application of AI and Machine Learning as well as BigData methods to plasmas are strongly encouraged. Basic also covers unique&boundary category of plasma physics such as dusty/strongly couples/quantum plasma physics, non-neutral plasmas, A&M in plasma and other emerging plasma physics.

2. **Type:** Invited
3. **Speaker:** Liming Yu
   E-mail: yulm@swip.ac.cn
   Affiliation: Southwestern Institute of Physics
4. **Rationale**: The energetic electrons (EEs) can be generated directly by lots of ways, e.g., toroidal Ohimc electric field and radio frequency heating (electron cyclotron resonant heating/current drive (ECRH/ECCD) and low hybrid current drive (LHCD)). Besides, energetic ions (EIs), produced by neutral beam injection (NBI) and ion cyclotron resonant heating (ICRH), and 3.5~MeV alpha (α) particles generated by D-T reaction in burning plasma will heat the background electrons firstly, when the energy of EIs and α is higher than critical energy. Abundant EEs induced magnetohydrodynamic (MHD) instabilities and even their nonlinear interactions have been identified and studied in experiment.
   The small resonant particle orbit width of EEs can be utilized to simulate and analyze the analogous effect of α characterized by small dimensionless orbits similar to EEs in tokamak plasmas. The 20 MW/5 GHz LHCD system is designed for current drive and assisted ramp-up in ITER. The serious MHD instabilities maybe excited by the EEs during high-power LHCD.
   Two kinds of basic EE induced low-frequency MHD instabilities, core electron fishbone (eFB) and edge electron beta-induced Alfvén eigenmode (eBAE), are found and studied during co- and counter-current drive LHCD plasma on HL-2A. The eBAEs on LHCD plasma are found for the first time. The investigation on MHD instabilities in different current drive direction LHCD plasma will provide important experimental experiences for current drive and burning plasma for ITER and DEMO.
5. **Short abstract for 4th Asia-Pacific Conference on Plasma Physics**

   Authors: L.M. Yu, W. Chen, Z.B. Shi, T.B. Wang, X.T. Ding, X.Q. Ji, R.R. Ma, P.W. Shi, X.Y. Bai, J.X. Li, B.S. Yuan, Y.G. Li, Z.C. Yang, Rui Ma, X.M. Song, B. Lu, J.Q. Dong, W.L. Zhong, Yi Liu, L.W. Yan, Q.W. Yang and M. Xu

   Title: Experimental Observation of Low-frequency MHD Instabilities Driven by Energetic Electrons in LHCD Plasmas

   Abstract: Energetic electron (EE) driving low-frequency MHD instabilities, e.g., electron fishbone modes (eFBs) and beta induced Alfvén eigenmodes (eBAEs), are found in co- and counter-driving low hybrid current drive (LHCD) plasma on HL-2A, respectively. The eBAEs are found in LHCD plasma for the first time. Two branches eFBs are observed in the core of plasma, and they can transit from the high-frequency one to the low-frequency one. The different mode structures and located positions are obtained by tomography of soft X-ray arrays. The frequency jump phenomena of eFBs are also found. While, the two eBAEs, with poloidal and toroidal mode numbers as m/n=3/1 and 5/2, are found in the edge of plasma. The m/n=3/1 mode is found when LHCD power (P_{LHCD}) is 0.44 MW. The strong m/n=5/2 mode appears, and the weak 3/1 mode coexists when P_{LHCD} =0.52 MW. Although, the current drive directions of LHCD are opposite with plasma current, the two eBAEs still propagate in electron diamagnetic drift direction in poloidal. With the increase of PLHCD (or changed current-profile), the value of the edge safety factor (q) decreases. The evolutions of the mode numbers of eBAEs are related with the change of the edge q factors.