AAPPS-DPP 2018 Plenary speaker Name: Prof. Peter H. Yoon
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Rationale: The candidate made many important and fundamental contributions in the area of kinetic plasma instabilities and their dynamical consequences on the solar wind evolution. According to the (double) adiabatic theory, expanding solar wind is supposed to generate extreme parallel pressure anisotropy owing to the conservation of moments. However, observations made near 1 A.U. show that the actual pressure anisotropies for the electrons, protons, and alpha particles are nearly isotropic with the upper and lower bound of the temperature anisotropies constrained by various marginal stability conditions associated with kinetic plasma instabilities. This has led to intense researches in the space plasma physics community. The candidate made many unique contributions on these efforts, which includes the pioneering self-consistent quasilinear plus collisional kinetic model of the solar wind. The candidate will overview the basic plasma physics inherent to the solar wind research, and as such, his plenary talk will be very appropriate for the conference.

Talk Title: Dynamic role of kinetic plasma processes in the solar wind

Short abstract: Why the atmosphere of the Sun is a thousand times hotter than the surface of the Sun (the coronal heating problem) and why the upper atmosphere of the Sun suddenly organizes to attain an outward motion at a certain solar altitude (solar wind acceleration) are mutually related outstanding problem in the contemporary space and astrophysics. The NASA's Parker Solar Probe and ESA's Solar Orbiter represent historic return to the inner heliosphere, since the Helios mission in the 1970s and Ulysses mission in the 1990s, in order to study this problem. It is generally believed that kinetic plasma processes play important roles in the corona and solar wind dynamics. Among such kinetic processes is the role of kinetic plasma instabilities driven by the electron, proton, and alpha particles. Satellite observations made near Earth orbit show that the space plasma exhibits various degrees of temperature anisotropies that do not obey the fluid dynamical predictions. Instead, measured temperature anisotropies appear to follow the dictates of marginal kinetic instability conditions. By understanding and accurately modeling the plasma conditions in the near Earth environment it is possible to interpolate the model back toward the Sun, so as to help interpret in situ Äi0data to be collected by the above-mentioned inner heliospheric missions. The present review will cover the present status of the solar wind modeling that includes the effects of temperature anisotropy instabilities operative in the solar wind, the dynamical consequences of such instabilities, the effects of binary collisional relaxation processes, and the effects of large-scale density and magnetic field gradients. The nominee's review article [Yoon, 2017] summarizes the recent developments. The present talk will also overview the general problem of coronal heating/solar wind acceleration problem from the perspective of kinetic plasma processes.

List of related published papers

[1] P. H. Yoon, Kinetic instabilities in the solar wind driven by temperature anisotropies, *Rev. Mod. Plasma Phys. 1, 4 (2017);* doi: 10.1007/s41614-017-0006-1
[2] P. H. Yoon and M. Sarfraz, Interplay of electron and proton instabilities in expanding solar wind, *Astrophys. J. 835, 246 (2017)*; doi: 10.3847/1538-4357/835/2/246
6.3 P. H. Yoon, Proton temperature relaxation in the solar wind by combined collective and collisional processes, *J. Geophys. Res. 121, 10,665 (2016)*; doi: 10.1002/2016JA023044
6.4 P. H. Yoon and J. Seough, Proton-cyclotron and firehose instabilities in inhomogeneous plasmas, *J. Geophys. Res. 119, 7108-7119 (2014)*; doi: 10.1002/2014JA020261
6.5 J. Seough, P. H. Yoon, K.-H. Kim, and D. H. Lee, Solar wind proton anisotropy versus beta relation, *Phys. Rev. Lett. 110, 071103 (2013)*; doi: 10.1103/PhysRevLett.110.071103