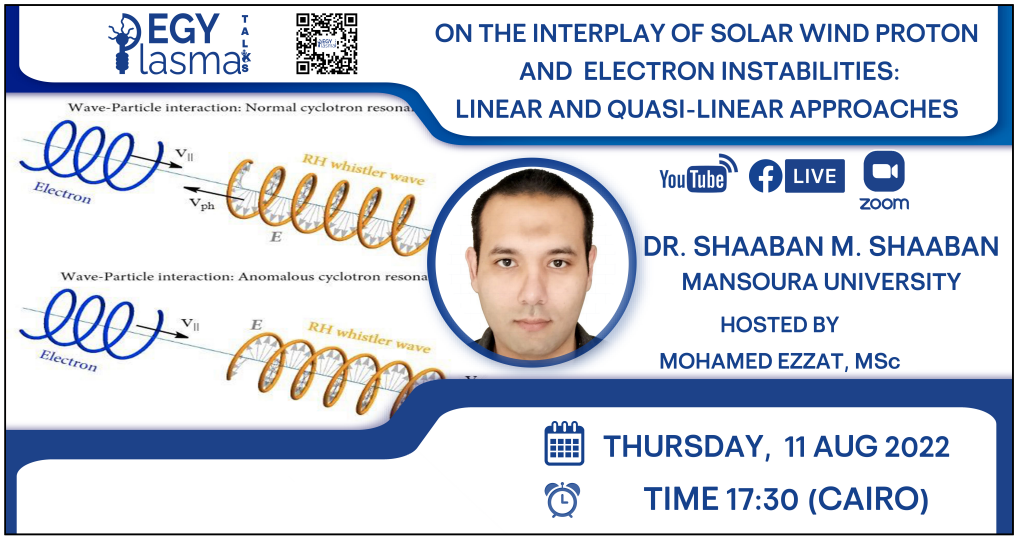

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Title: On the interplay of solar wind proton and electron instabilities: linear and quasi-linear approaches

Speaker: Dr. Shaaban M. Shaaban (Mansoura University)

When: 2022-08-11 17:30:00 - **Hosted by**: Mohamed Ezzat, MSc

Abstract: Important efforts are currently being made to understand the so-called kinetic instabilities, driven by the anisotropy of different species of plasma particles present in the solar wind and terrestrial magnetosphere. These instabilities are fast enough to efficiently convert the free energy of plasma particles into enhanced (small-scale) fluctuations, with multiple implications, regulating the anisotropy of plasma particles. In this paper we use both linear and quasi-linear (QL) frameworks to describe complex unstable regimes, which realistically combine different temperature anisotropies of electrons and ions (protons). Thus various instabilities are parametrized, for example the proton and electron firehose, electromagnetic ion cyclotron and whistler instabilities, showing that their main linear properties are markedly altered by the interplay of anisotropic electrons and protons. Linear theory may predict the strong competition of two instabilities of different natures when their growth rates are comparable. In the QL phase, wave fluctuations grow and saturate at different levels and temporal scales, in comparison to results for the individual excitation of the proton or electron instabilities. In addition, the cumulative effects of the combined proton- and electron-induced fluctuations can markedly stimulate the relaxation of their temperature anisotropies. Only whistler fluctuations inhibit the efficiency of proton firehose fluctuations in the relaxation of anisotropic protons. These results offer valuable premises for further investigations in numerical simulations to decode the full spectrum of kinetic instabilities resulting from the interplay of anisotropic electrons and protons in space plasmas.

Email: info@egyplasma.com - **Website**: egyplasma.com/talks/