THEORETICAL PHYSICS SEMINAR

Title: Breaking of longitudinal relativistic plasma waves and fourth order
finite volume numerics for simulating accretion disks

Speaker: Prabal Singh Verma, Tech. Univ. Berlin

Date/Time/Venue: 14th October (Friday)/2:30 PM/ Room No. 469

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Tea will be served at 3:30pm outside Room 469
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ABSTRACT

One of the major challenge in particle acceleration experiments is to achieve very high energetic charged particles. These high energetic particles are being used in cancer therapy, cutting and melting of hard materials and in understanding high energy physics problems. In conventional accelerators the accelerating electric field can not go beyond a few hundred MV/m due to the breakdown of the material. On the contrary, plasma which already is a broken state of matter can support extremely high electric field (TV/m) in the form of electrostatic plasma waves[2-9]. These waves can be excited as wakefields by sending a laser/particle beam pulse in to the plasma. Amplitude of such plasma waves is limited by a phenomenon called wavebreaking which transforms the coherent electrostatic energy of the wave into the random kinetic energy and thus damps the wave[1]. Therefore, understanding of wavebreaking criteria for plasma waves is important because it can significantly affect the maximum achievable energy in wakefield acceleration experiments. In the first part of my presentation I will talk about the the evolution and breaking of longitudinal relativistic plasma waves in a cold plasma [2].

In the second part, I will talk about the high order numerics for simulating accretion disks. Such disks are formed due the accumulation of matter on to a massive central object and the magnetorotational instability (MRI), which just requires a subthermal magnetic field to break the Keplerian flow into turbulence, is believed to be the most likely mechanism behind the accretion process. Most of the studies on the nonlinear development of the MRI rely on numerical simulations due to the inherent difficulties in approaching strongly nonlinear problems analytically. We have adopted shearing-box approximation [12] , where the computational domain is restricted to a region of small radial extent compared to its radial distance from the disk’s center, is a standard and well defined physical model to understand the nonlinear behaviour of the MRI. The existing numerical tools for MRI simulations are in general second order accurate and since second order schemes are known to have high numerical diffusion, we have developed fourth order accurate finite volume shock capturing code [13, 14] to study the nonlinear behaviour of magnetorotational instability (MRI). I will here

talk about the issues we have encountered during the development of high precision code.

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All are welcome to attend