Litteraturkurs för Erik Engwall: Probmätningar i magnetosfärplasma (5 p)

Utkast 0.1

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1 Beskrivning

En litteraturkurs omfattande ett antal grundläggande artiklar i två ämnesområden relevanta för Eriks vidare doktorandarbete: probteori och plasmapopulationer i magnetosfären, speciellt kallt plasma.

1.1 Omfång

Kursen omfattar 5 poäng. Om vi utgår från att en artikel kräver en dags studier motsvarar detta 25 artiklar, evt något fler om de är korta.

1.2 Mål

- Att erhålla för fortsatt forskningsarbete relevanta fördjupning av kunskaper i:
  1. hur objekt i rymden elektrostatiskt växelverkar med omgivande plasma, utöver vad som ingått i kursen Plasmafysik och i examensarbetet, samt i
  2. kända egenskaper och fördelning av plasmapopulationer, speciellt kallt plasma, i magnetosfären, utöver vad som ges i kursen Rymdfysik NV1.
- Att få vana vid att söka, läsa, diskutera och sammanfatta vetenskapliga artiklar.

1.3 Examination

Examinationen sker i två steg:

1. En skriven sammanfattning omfattande 5 - 10 sidor, producerad fortlöpande och avsnittsvis behandlad under...
2. ... ett antal diskussioner med examinator, omfattande ungefär fem artiklar i taget. För schemaläggning se avsnitt 1.4 nedan.

1.4 Tidsplan

Kursen avslutas under vårterminen 2004. Första examinationstillfället är preliminärt torsdagen den 12 februari kl 13.

2 Artiklar att studera

2.1 Basic and applied probe theory

[1] is a paper on auroral physics, but it is pointed out that the physics is the same as for probe theory. I believe this may be the best starting point. [2] is the basic paper on orbital motion limited (OML) theory. [3] actually does calculations for a situation with an anisotropic (flowing) plasma, also including the case of a finite sheath, though without explicit calculation of the sheath size.

2.2 Electric field measurments

The most recent summary of the double-probe technique is the paper by [4]. However, some aspects are better produced in the earlier papers by [5], [6] and [7].

Problems with E-field measurments may be of different kinds. Density gradients are treated by [8]. Another problem is shown in [9].

For the EDI technique, [10] is the main reference. The method of active sounding or passive plasma mode identification for determining plasma density used by WHISPER on Cluster is described in [11] (where the results presented should be studied for what they tell about the method more than for any particular interest in the results as such).

The density-potential relation has been the subject of much work. The papers [12] and [13] are central, as is [14]. The topic is closely related to photoelectron properties. As far as I am aware, the best study still is the paper by [15].

2.3 Magnetospheric plasma

A good review of ion outflow from the ionosphere is found in [16]. Note that most of this paper is about how the plasma has escaped to the magnetosphere from the ionosphere, particularly heating mechanisms, but it nevertheless serves to put things into context. That the ionosphere is a main source for magnetospheric plasma is well argued by [17]. Modern studies of the polar wind and low-energy ion outflow are [18], [19] and [20]. The latter considers variations with magnetospheric conditions, which is quite important if we want to understand not only where but also when we can expect to find cold plasma.

Polar wind theory is complex and inclined to go into fluid equations to several moments and is not within the scope of this course: however, the small paper [21] is very nice as it is comprehensive, understandable and puts the polar wind into the context of solar and stellar winds.

Cold plasma can be found in other magnetospheric regions than the polar wind proper. The most recent study is probably the work by [22]. Also relevant clearly is

Jean-André's previous Cluster paper, [23], and similar studies from Polar studies [24]. Neither the old paper [25] nor the more recent study [26] should be forgotten.

References

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