

Weak electron acoustic double layers in a multicomponent plasma

K S GOSWAMI and S BUJARBARUA

Institute of Advanced Study in Science and Technology, Assam Science Society, Khanapara, Gauhati 781 022, India

MS received 24 March 1986; revised 2 December 1986

Abstract. Formation of electron acoustic double layers in a magneto-plasma with two ion species is investigated. The existence of double layers propagating almost perpendicular to the magnetic field in a plasma with two distinct ion species and cold electron is discussed.

Keywords. Electron acoustic double layer; multicomponent plasma; single-ion species, two-ion species.

PACS No. 52.35

1. Introduction

A large number of theoretical (Block 1972; Torven 1981), computer simulation (Hubbard and Joyce 1979; Kim and Crystal 1984) and experimental (Coakley and Hershkowitz 1979; Temerin *et al* 1982) investigations have been carried out on the double layers. Recently Kim (1983) and Schamel (1983) showed that slow electron acoustic double layers (SEADL) and slow ion acoustic double layers (SIADL) can be constructed considering the effects of reflected electrons and reflected ions. However, Goswami and Bujarbarua (1985, 1986a) have shown that small amplitude ion acoustic double layers can be constructed without considering the effects of reflected particles. But in such a situation at least two types of free electrons (each described by a Maxwellian distribution) are necessary to construct such double layers. From the earlier theory of double layers (DL) it has been found that they are generally associated with the ion acoustic branch, while theoretical studies of electron acoustic solitary waves, propagating almost perpendicular to the magnetic field in a plasma with ion temperature very much larger than the electron temperature, have been performed extensively (Arefev 1970; Goedbloed *et al* 1973). Buti (1980) investigated an exact nonlinear electron acoustic waves in a multicomponent plasma and showed the effects of second ion components. With this idea in mind, the existence of small amplitude electron acoustic double layers or shocks in plasma has been investigated by Goswami *et al* (1986).

In this paper, we study the existence of small amplitude electron acoustic double layers or shocks in a multicomponent plasma. Using fluid equation for electrons and describing ion components by the Maxwell-Boltzmann relation, i.e. the free particle temperature and the reflected particle temperature of the two-ion species to be equal, we first describe the method of finding solutions with a potential ϕ that varies monotonically from a minimum value, zero to maximum value ψ (amplitude of the