

**STIMULATION OF CHARACTERISTIC FREQUENCIES
OF ELECTRON POPULATION
BY ACTIVE INSTRUMENTS ON CLUSTER**

**O. C. Randriamboarison^{(1)*}, P. Décréau⁽¹⁾, J.-L. Rauch⁽¹⁾, H. C. Séran⁽¹⁾, J.-G. Trotignon⁽¹⁾, P. Canu⁽²⁾,
J. Pickett⁽³⁾, L. Ahlén⁽⁴⁾, M. André⁽⁴⁾, S. Frey⁽⁵⁾, G. Pashman⁽⁶⁾**

⁽¹⁾ LPCE/CNRS, Université d'Orléans
3A, avenue de la Recherche Scientifique
F-45071 Orléans cedex 02 France

Fax 33 2 38 63 12 34 ; * Phone: + 33 2 38 25 76 48 E-mail: randriam@cnrs-orleans.fr

⁽²⁾ CETP/CNRS, Université Versailles Saint-Quentin-en-Yvelines
10/12 avenue de l'Europe
F-78140 Vélizy FRANCE

⁽³⁾ Department of Physics and Astronomy,
University of Iowa
IA 52242 Iowa City USA

⁽⁴⁾ Swedish Institute of Space Physics,
Uppsala division, Box 537, Angström Laboratories
S- 75 121 Uppsala Sweden

⁽⁵⁾ Space science Laboratory,
University of California,
Berkeley, CA 94720, USA

⁽⁶⁾ MPI für Extraterrestrische Physik,
Postfach 1603,
D-85740 Garching, Germany

Magnetospheric relaxation sounders have proven to be quite efficient for the stimulation of characteristic resonance of the local electron population, even so they inject only a modest amount of energy in the surrounding plasma (typical injected power of order 1W used during a transmission of order 1 ms duration). The experience gained at this date on the few projects operating similar devices (from GEOS, launched year 1977, to CLUSTER, launched year 2000) has provided a good empirical knowledge of the sounder's functioning and performances. The main mechanism at work seems to be the so called 'accompanying waves' mechanism. Indeed, the observations show the presence of spectral lines at frequencies which would be 'forbidden' in the alternative mechanism of 'refracted oblique echoes'. Today, a realistic quantitative model of the antenna/plasma coupling is not yet available; hence the improvement of empirical knowledge is quite welcome. This has been possible thanks to the CLUSTER project, carrying a sophisticated scientific payload, in particular the WHISPER relaxation sounder, which uses a vector signal processor for spectral analysis by FFT, the Wide Band (WBD) Plasma Wave investigation which gives access to high resolution measurements of electric field waveforms, by a high rate downlink to the NASA Deep Space Network, and EDI, the electron drift instrument, which, by injecting a modulated electron beam in the plasma, has been found to act as an active transmitting antenna, stimulating plasma resonances

In this paper, we will start the presentation by a brief summary of the performances of the WHISPER relaxation sounder. We will then concentrate on three specific questions:

- 1) What is the response of the medium over a large frequency band when triggered by a narrow band sine wave train (the pulse sent by WHISPER's transmitter)? Measurements obtained in the commissioning phase have already shown that a resonance at a given characteristic frequency can be triggered by a pulse centred at a quite different frequency. The WBD measurements allow to answer this question in more details, and may thus provide first approximations about the total energy deposit in the medium.
- 2) How does the medium respond to the EDI 'beam antenna'? Examples will be presented and discussed.
- 3) Is there a possibility that a signal, transmitted from one of the four CLUSTER spacecraft, is observed on-board another spacecraft of the fleet? Specific tries will be operated during the 2002 late winter and early spring frame time, as the separation distance can go down 100 km in this period.