Listening to the magnetosphere How best to make ULF waves audible

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Imperial College Listening to ULF waves London

Human hearing has benefits over typical visual analysis Can make ULF waves audible simply by speeding up playback



Alfvén mode

Fast mode Surface mode

... but can make orbits go by too quickly for missions like THEMIS

Imperial College Time-stretching

Existing methods developed in audio/music

Rather than space scientists pick "best" conducted an online survey for experts in TSM factor audio, science communication etc. (n=140)

Resulted in recommendations of how to make ULF waves audible for future projects

ndation	Recommend]	ation	
se vocoder	Wavelet phase	1	vocoder	
	$6 \times$			Nois
ess contour	Equal-loudness		contour	
) Hz	44,100 H		z	
per interval	Normalisation pe		er interval	



Submitted to special collection on ULF waves in Frontiers

Imperial College London **Possibilities**

Addressing science questions

e.g. Alfvén continuum can be difficult to identify via visual or automated methods.

Citizen science

Listening has low barrier to entry and citizen science can help tackle *big data* being produced.

Communication / engagement Powerful tool for captivating broad audiences in various ways.



Sonification tools could also be applied to other waves: EMIC, ECH, seismic etc.