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Anomalistic wave propagation phenomena in whistler waveforms detected on wide-band VLF recordings of the DEMETER satellite

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Several anomalistic, unexplained wave phenomena appeared on the VLF burst recordings of the DEMETER satellite. These effects fall not into any previously described groups of unexplained signatures of VLF waves recorded on board.

Numerous whistler shaped signals exhibited splitting traces on the detailed dynamic spectra. The traces deviate at a certain frequency, forming a signal part perfectly corresponding to a conventional, field aligned propagated whistler while a fractional curve may not be fitted to any known whistler model. A single example of ground based whsitler recordings, acquired at Agra, India at low magnetic latitudes is known showing similar trace split effect.

The phenomenon, termed as "swallow-tailed whistler" (STW) after its shape, seems to be similar to a conventional whistler, but following the main trace, another trace appears with monotonously increasing frequency joined at a given Starting Furcation Frequency (SFF). In the spectrogram a time lag of 30-50 ms is sometimes observable at the SFF after the hypothesized main trace. In a seven-month-long time interval three series of strong STWs were found in a geographically confined zone. Further 10 weaker STW period have been identified by a thorough review of a two-month-long recording. Based on comparisons with previous studies we exclude the relationship of the phenomenon with the plasma in the vicinity of the satellite, though the generating mechanism of the signal is so far unclear.

In order to model and quantitatively describe these phenomena new wave-medium interactions need to be derived and applied in the full-wave impulse propagation models.