Fine space and time structure of pulsating aurora and VLF-chorus emissions

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Several well-known facts demonstrate that some very fast and effective processes of wave-particle interaction can operate inside the magnetosphere:
1. TV data reveal appearance of a new details in pulsating aurora with the time scale of one TV frame (40 milliseconds).
2. X-rays microbursts often have exclusively fast front with a rising time shorter than 20 ms.
3. Satellite particle detectors counting rate can increase for 10 times during 50 ms and that is mostly telemetry speed limits.
4. Ground based VLF chorus observations demonstrate fine details of the chorus structure at the time scale of some milliseconds, though this fact always was explained as a purely propagation effect (summarizing in the receiving VLF antenna signals with a neighbour frequencies and random phases).

But advanced spectral analyses we have used revealed that very fine time and spectral structure is an essential feature of the satellite detected VLF chorus as well. Another question we tried to answer is there any relationship between fine structure of chorus and precipitating electron fluxes. For that purpose we have studied thousand hours of auroral TV observations with synchronously recorded chorus and found several cases of isolated pulsating patches and definitely corresponding them VLF-chorus emissions. Using different methods of autoregression models spectral analyses, TV image enhancement procedures and methods of integral projection functions it was found that good correlation between fine structure of chorus and small details of optical pulsations exists. Our conclusion is that chorus structure is not a propagation effect but more probably a result of close and fast wave-particle interactions in the different areas of a highly structured region of generation at the magnetosphere equator.