Using Wavelet Transform (WTN) for Fabry-Perot interferometer data processing

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In the modern interferometric investigations high-sensitivity CCD-TV cameras are widely used. As the camera creates high-resolution image (typical size is 512*512 pixels, or 264 Kbytes) every 1-3 minutes, there are serious problems of data storage and acquisition. Even after 16 points image averaging, size of the digital frame is 16 Kbytes. Special procedure of the frame scanning is usually used, and only the resulting information about Doppler profile is recorded into the computer memory (file size is about 1-2 Kbytes). But in this case all the initial frame information is lost, and, for example, control of the CCD-matrix dark current (that is important for correct detection of the Doppler profile maximum) becomes very difficult (dark current is non-uniform along the frame and astable in time). It would be very desirable to find some simple, fast and effective method of direct interferometric image data compression.

We represent some preliminary results of use the two-dimensional Wavelet Transform (WTN). Because of the special image geometry (concentric rings plus strong noise), WTN compression happened to be very effective, resulting image can be as small as 0.25 Kbytes (about 1.5 percents from initial 16 Kbytes) and contains most of non-compressed frame important information. Another positive effect of WTN compression is a good image filtering and improving s/n ratio. Some disadvantage of compression is a small parasitic shift of the Doppler profile maximum, but preliminary study has shown, that shift is systematic, predictable, depending mostly on a compression level and so can be easily controlled and corrected.

WTN-based data filtering can be successfully used and for many other kinds of information, for example, auroral (frames and keograms), VLF emissions spectrograms, magnetic pulsations and many others.