

Recent experiments with rubidium and cesium vapor illuminated by the femtosecond laser frequency comb centered at either D2 or D1 lines will be described. The usual Doppler profile was transformed into very peculiar profile in which periodic structure can be observed by the weak cw laser scanning probe. Modulations in the hyperfine absorption line profiles were observed as a direct consequence of the velocity selective optical pumping induced by the frequency comb excitation. We shall show the results of the use of a hyperfine atomic filter, which selectively absorbs frequency comb lines over the Doppler profiles.

In our atomic systems the coherence relaxation time is longer than the laser pulse repetition period. Atoms interact with the spectrum of the pulse train, and not with the spectrum of a single pulse. This opens up a possibility for the high resolution spectroscopy, where the observed linewidths are much less than the Fourier-transform limit of the individual pulse in the train. Whether this new method can be applied to cooling atoms and molecules will be discussed.