Investigation of the structure of magnetic islands in the FT-2 tokamak by upper hybrid resonance Doppler backscattering [[1]](#footnote-1)\*)

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In the FT-2 tokamak (major radius 55 cm, radius of the limiter 7.9 cm) ohmic hydrogen discharge with a plasma current 34 kA, a density 2.21013 cm-3, an electron temperature 560 eV, and a magnetic field 2.18 T, the inhomogeneity of the poloidal rotation of the plasma in the presence of magnetic islands was studied. The Doppler backscattering in the upper hybrid resonance (UHR) was utilized [1] to measure the poloidal velocity *v*. Radial plasma scanning was provided by changing the frequency of microwave probing. Typical features of the time evolution of the Doppler frequency shift signal 2*f*D(*t*) = ***v* are the shift of its mean level from zero, which is proportional both to the mean velocity of the plasma poloidal rotation and the poloidal projection of the wave number of scattering density fluctuations **, as well as the presence of intense coherent oscillations associated with fluctuations of the poloidal rotation due to the development of the geodesic acoustic mode (GAM). These oscillations manifested themselves in a wide range over a small radius from 4.5 to 6.3 cm. In the region 4.6 см < *r* < 5.1 см, where the resonant magnetic surface with *q* = 2 was located, an additional spectral component was recorded in the Doppler shift spectrum. Its frequency was identical to the frequency of the line dominating the spectrum of the MHD probe signal, and the coherence of the two indicated signals at this frequency reached 88%. According to the magnitude of the cross-phase of the signals from two poloidally spaced MHD probes, it was confirmed that this line in their spectrum refers precisely to the m = 2 (n = 1) mode. A significant drop in the correlation between the Doppler shift signal and the MHD probe signal was observed at the radial shift of the scattering region from the center of the magnetic island by *r* = ±0.25 см. With an mean value of the Doppler shift <*f*D> = 1.2±0.1 MHz near *r* = 5 cm, the amplitudes of its oscillations associated with the GAM and the MHD were *f*DGAM = 0.24±0.05 MHz and *f*DMHD = 0.29±0.05 MHz. Assuming that the fluctuations in the Doppler shift of the scattering spectrum at the MHD frequency are associated only with the modulation of the poloidal rotation velocity in the island, one can obtain an upper estimate for the magnitude of these fluctuations *v*MHD. To determine the velocities, the correlation measurements of the wavenumbers of density fluctuations on which scattering occurred near *r* = 5 cm were performed. At the value of the average velocity <*v*>  2.5 km/s, the amplitudes of its velocity associated with the GAM and the MHD turned out to be *v*GAM  0.5 km/s and *v*MHD  0.6 km/s, respectively. An alternative mechanism for the appearance of the Doppler shift oscillations at the MHD frequency is the oscillation of the quantity **. The reason for this phenomenon can be related to the periodic distortion of the UHR surface shape near the magnetic island, both due to the perturbation of the radial density profile in it, and due to the change in the shape of the magnetic surface associated with the modulation of the magnetic field by the MHD perturbation. Estimates of the influence of these effects on the modulation of the Doppler frequency shift were made for various density and magnetic field perturbations.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/AO-Batyrev.docx) [↑](#footnote-ref-1)