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EUV observations of the inner corona and identification of the slow solar wind sources in active regions

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Systematic EUV observations of the inner solar corona in a global scale up to distances 2.5-3Rsun were started with the CORONAS-F/SPIRIT EUV telescope-coronagraph in 2002 at high solar activity. It was shown that sometimes the inner corona comprises extended ray-like structures which originate from some active regions and look most bright in cold Fe IX-XI lines. From the ULYSSES and ACE data it follows that active regions are potential sources of quasi-stationary slow solar wind, so these rays are probably indicate the solar wind streams in the inner corona. To verify this assumption, observations of the inner corona were continued in 2009 with the CORONAS-Photon/TESIS telescope and in 2010 with the PROBA2/SWAP telescope combined with a search of outflows from the solar disk with the Hinode/EIS EUV spectrometer. SWAP investigates the inner corona up to 2Rsun by using summation of sequential images taken in four off-point positions. We report here the results obtained during October 7 – 21, 2010 when the AR 11112 was observed with SWAP and Hinode/EIS as well as with the SDO/AIA telescope. At the Western limb (October 20-21), SWAP observed a rich structure of extended coronal rays originated from the AR 11112 at the latitude where earlier EIS detected outflows at the disk from the Doppler shifted Fe X-XV lines. The PFSS extrapolation has shown that the magnetic configuration of the outflow regions contained open field lines spatially correlated with fan rays seen in Fe X line. The spectroscopic analysis of the differential emission measure function from intensities of the Fe-ion lines measured by EIS revealed a multitemperature structure of plasma in different points of the AR with an excess of 1 MK component in the places of outflows. The ACE measurements and Wang-Sheely-Arge modeling showed a correlation between values of the solar wind velocity ($\sim$400 km/s), Fe/O ratio ($\sim$ 0.1-0.2) and positions of outflows in the AR 11112. Summarizing, we conclude that the observed coronal rays represent direct signatures of the quasi-stationary slow solar wind in the inner corona.