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Structure and evolution of coronal holes observed with Hinode XRT

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Abstract. We report structure and its dynamic evolution, both in intensity and temperature, of coronal holes observed with the X-Ray Telescope (XRT) aboard Hinode. One of the prominent features of XRT is that it can well observe low-temperature corona (even below 1 MK) thanks to the combination of a back-illuminated CCD device and a suite of thin metal foils as focal-plane analysis filters. This feature, coupled with high-cadence imaging capability of XRT, has enabled us for the first time study in detail dynamic evolution of intensity/temperature structure of the X-ray corona.

We carried out deep-exposure observations with a set of thin filters, including the thinnest Aluminum-on-mesh (Al/Mesh) filter, on equatorial coronal holes and their surrounding quiet Sun. Coronal hole that has been studied primarily is the one near the disk center on 27-29 April 2008, when no active region was present on the solar disk. This coronal hole was observed extensively, with a pair of Al/Mesh and Titanium-on-Polyimide (Ti/Poly) filters with each filter pair taken every 90 seconds. As this coronal hole was located near the disk center, we expect that, along the line of sight, X-ray emission from the hole was less contaminated by that from (diffuse) X-ray loops from the surrounding quiet Sun as compared to coronal holes near the limb, hence more suited to study physical conditions inside coronal holes.

When seen with the Al/Mesh filter, the coronal hole is by no means very dark (*i.e.*, less contrast to the quiet Sun than the one seen with thicker filters), but instead exhibits frequent transient brightenings across the hole with time scale of a few minutes. The observed brightenings indicate frequent emergence and submergence of magnetic flux near the base of the coronal hole, from the lower atmosphere. The boundary portions of the coronal hole are generally low in temperature (at, or slightly lower than, 1 MK) with the lowest-temperature portion ($\lesssim$ 0.8 MK) created in association with apparent change in magnetic configuraiton near the boundary of the coronal hole.

Details of evolution in temperature and intensity structure of coronal holes will be presented and their implication discussed.