Revisiting the Strongest Martian X-Ray Halo Observed by XMM-Newton on 2003 November 19–21

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On 2003 November 20–21, when the most intense geomagnetic storm during solar cycle 23 was observed at Earth, XMM-Newton recorded the strongest Martian X-ray halo hitherto. The strongest Martian X-ray halo has been suggested to be caused by the unusual solar wind, but no direct evidence has been given in previous studies. Here, based on the Mars Global Surveyor (MGS) observations, unambiguous evidence of unusual solar wind impact during that XMM-Newton observation was found: the whole induced magnetosphere of Mars was highly compressed. The comparison between the solar wind dynamic pressure estimated at Mars from MGS observation and that predicted by different solar wind propagation models suggests that the unusual solar wind is probably related to the interplanetary coronal mass ejection observed at Earth on 2003 November 20.