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Are Dawn Storms Jupiter's auroral Substorms?

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There are multiple evidences that mass and energy rarely circulate smoothly in planetary magnetospheres. To the contrary, these systems tend to accumulate them until they fall out of balance through reconfiguration events. The source of mass and the source of energy can differ, as well as the trigger that initiates the collapse. However, despite some fundamental differences between the planets, the auroral signatures of the global reconfigurations bear many similarities that inform us on the common physical processes at play. For the first time, Juno has granted us a complete and global picture of one type of such reconfigurations, the auroral dawn storms, from their initiation to their vanishing. Juno actually captured views of dawn storms at different stages of development in approximately half of the cases.

For example, on PJ11 and PJ16, Juno-UVS caught the brief appearence of small elongated spots located poleward of the main emission in the midnight sector. In both cases, a few hours later, the main emission began to brighten and broaden in the same sector. Then the main arc split into two parts, one moving towards the pole and the other moving equatorward. The whole feature also started to rotate towards the dawn sector, progressively accelerating to co-rotation. On PJ6, Juno-UVS observations missed the beginning of the event, but they allowed us to examine the next phase. After the broadening and the splitting of the main emission, the outer arc transformed unto large blobs. During the same time interval, subsequent Hubble Space Telescope images confirmed that the blobs kept on evolving, forming latitudinally extended fingers. All these auroral features resemble auroral morphologies observed at Earth during substorms. The Jovian elongated spots look like terrestrial poleward boundary intensifications (PBIs), the poleward motion of the arc indicates a dipolarisation/current disruption and the blobs in the outer emissions suggest massive plasma injections.