First HST movies of Jupiter's UV aurora during the NASA Juno prime mission P33C-2147

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A large Hubble Space Telescope (HST GO-14634) program of 151 orbits was allocated in support of the NASA Juno prime mission. This HST campaign spans an 8-month period from November 2016 to August 2017. Here, we show the latest HST STIS movies of Jupiter's ultraviolet aurora, especially those obtained during Juno orbit PJ5 (perijove on 28 Nov 2016).
The primary goal of this HST campaign is to complement Juno-UVS (Ultraviolet Spectrograph) observations. This complementarity is four-fold as HST observes Jupiter's aurora when:
1) Juno-UVS is turned off, that is about 98% of Juno's 14-day orbit, and Juno's in situ instruments are in operation.
2) Juno-UVS is operating, but observes the opposite hemisphere of Jupiter.
3) UVS is on in the same hemisphere, but too close to Jupiter to have a global, contextual, view of the aurora and/or UVS is affected by the noise induced by Jupiter's radiation belts.
4) Juno is too far from Jupiter to get a detailed view of the aurora ...

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see revised abstract

Revised abstract: A large Hubble Space Telescope (HST) program was allocated in support of the NASA Juno prime mission. The numerous HST visits are distributed over the different orbits of Juno in order to complement the observations with Juno's in situ and remote sensing instruments. The present study focuses on a 16-day period bracketing Juno's perijove pass on December 11, 2016. This is the first time that HST is able to observe Jupiter's ultraviolet aurora in parallel with Juno. The Space Telescope Imaging Spectrograph (STIS) is used in time-tag mode to provide spatially resolved movies of Jupiter's highly dynamic aurora. The field of view of the STIS instrument encompasses one hemisphere of Jupiter and, depending on the orientation of the planet's magnetic field, allows one to observe a large portion of Jupiter's aurora. The auroral morphology contains detailed and instantaneous information about magnetospheric processes taking place in a vast region extending from the orbit of Io to the outer limits of the magnetosphere. As such, these movies are providing a global magnetospheric context to the different Juno instruments studying Jupiter's magnetosphere. The 16-day period covered by this analysis consists of 25 HST visits distributed in such a way as to observe Jupiter's aurora approximately every day with a temporal resolution as short as a few tens of seconds.

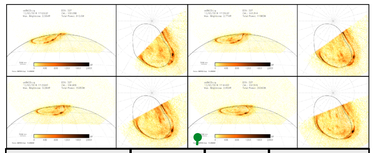
STIS time tag movies

Far-UV Multi-Anode Micro-channel Array channel on the Space Telescope imaging Spectrograph with the SrF2 filter attenuating the strong Ly-alpha line and contamination from geocoronal emissions. The plate-scale is of 0.0248 arcsec/pix (75 km/pix, PSF ~2-3 pix, 1024x1024 pix). Brightness/emitted power by H2 molecules in the 70-180 nm range, counts to kR conversion from Gustin et al. (2012). Each frame = 30sec of accumulation. Full movie duration ~45 min.

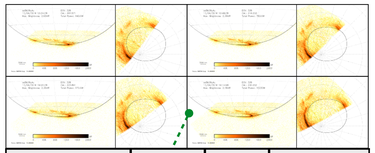
Frame A/243		Frame B/243	
Frame C/243		Frame D/243	
HST date	time	CML S3°	Juno-Jupiter light time (sec)
Juno date*	time	CML S3°	L-shell dipole

*HST date minus HST-Juno light time

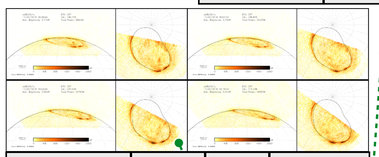
youtube tags: « HST Juno Jupiter aurora 14634»



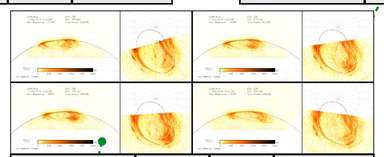
02Dec2016	17:01	131.4	18.5
02Dec2016	16:11	238.7	81 RJ



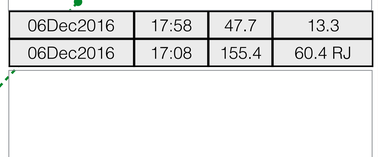
04Dec2016	13:31	305.4	16.4
04Dec2016	12:41	52.8	70 RJ



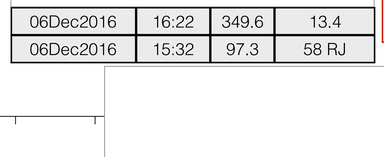
02Dec2016	18:36	188.9	18.4
02Dec2016	17:46	296.1	79 RJ



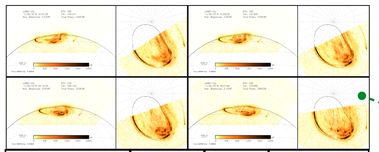
03Dec2016	13:41	160.9	17.6
03Dec2016	12:51	268.3	76 RJ



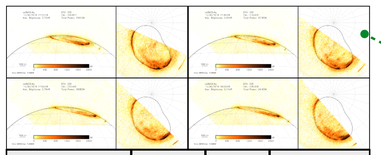
06Dec2016	17:58	47.7	13.3
06Dec2016	17:08	155.4	60.4 RJ



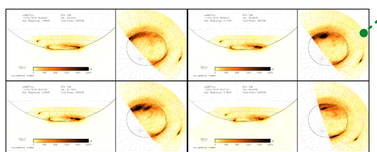
06Dec2016	16:22	349.6	13.4
06Dec2016	15:32	97.3	58 RJ



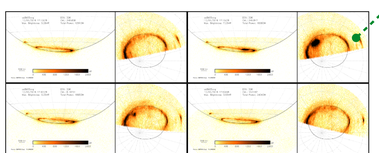
30Nov2016	15:45	144.6	20.5
30Nov2016	14:54	251.0	88 RJ



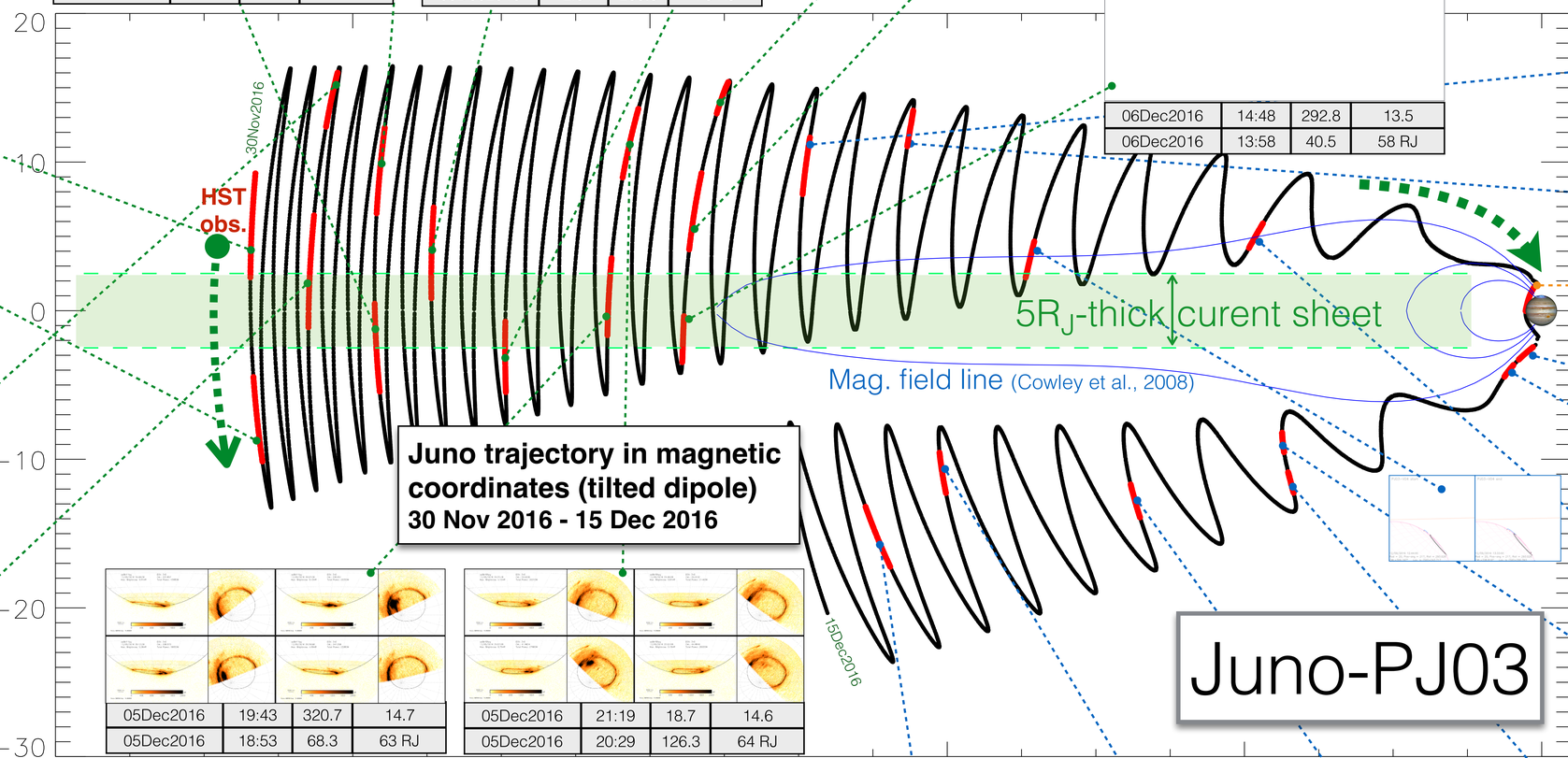
30Nov2017	17:20	202.1	20.4
30Nov2017	16:29	308.5	87 RJ



01Dec2016	18:45	43.9	19.4
01Dec2016	17:55	151.0	85 RJ



01Dec2016	17:10	346.4	19.5
01Dec2016	16:20	93.6	83 RJ



05Dec2016	19:43	320.7	14.7
05Dec2016	18:53	68.3	63 RJ

05Dec2016	21:19	18.7	14.6
05Dec2016	20:29	126.3	64 RJ

06Dec2016	14:48	292.8	13.5
06Dec2016	13:58	40.5	58 RJ

Perijove

Simulated STIS views (upside down)

HST data not yet available

Preliminary Discussion

So far, images obtained with HST-STIS are showing the expected structures: the main emission, the secondary emissions and satellite footprints. Some very strong individual polar events (ex: panel B 01Dec2016 17:10) are able to suddenly increase the total power by more than 40%. Details on specific auroral features may be found in the review by Grodent (2015) and references therein. Information on data reduction as well as on polar flares is given by Bonfond et al. (2016, in press).

References

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Cowley et al., AnGeo, 2008, doi:10.5194angeo-26-4051-2008
Grodent, SSR, 2015, doi:10.1007/s11214-014-0052-8
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