16118 - Chandra EUV Capabilities: A New View of Jupiter

Cycle: 28, Proposal Category: GO

(Availability Mode: SUPPORTED)

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) JUPITER-AURORA-WITH-CHANDRA	STIS/FUV-MAMA	1	01-Sep-2021 11:00:15.0	yes

1 Total Orbits Used

ABSTRACT

Over the last 3 decades, X-ray(<60A) and UV(>700A) observations by Chandra and the Hubble Space Telescope (HST) have continuously revolutionised our understanding of Jupiter, but the planet has never been spatially resolved at wavelengths between the X-ray and UV. We propose to leverage and develop recent pioneering observing techniques with Chandra[Drake et al. 2019] to conduct the first spatially resolved EUV(60-170A) observations of Jupiter. This will open an entirely new window of exploration for Jupiter, revealing key information on the processes dominating rapidly-rotating bodies and gas giant planets. To do this, we request a 36ks observation of Jupiter with the Chandra HRC-S thin filter, a 6ks observation with the thick filter, and a simultaneous HST orbit to constrain the UV flux.

OBSERVING DESCRIPTION

This observing time, won through the Chandra X-ray Observatory AO, seeks to leverage a new Chandra capability to take the first EUV (60-170 angstrom) image of a planet: Jupiter. To do this, a simultaneous HST observation of Jupiter's Northern Aurora is critical, in order to provide a constraint on the highly time variable UV flux at this time. Without this, the Chandra observation will be impossible to interpret, since it will be unclear the extent to which the detected emission is the never-before-seen EUV emission or contaminant UV emission.

The time constraint on the observation is therefore simultaneity with Chandra. We also request that the HST orbit takes place during an interval when the Northern aurora is in view (observable for half a Jupiter rotation so ~5 in every 10 hours).

Jupiter's northern hemisphere is best observed when the CML of Jupiter from Earth is between 120 and 220 (S3) deg. If it is not possible to observe the North during such a window, then for the southern hemisphere a CML between 290 and 120 deg would enable observations of the Southern aurora. However, we note that Jupiter's Southern aurora is tilted to limit visibility from Earth, while the North is tilted to favour it.

Observations of Jupiter's auroras will be obtained using the STIS/FUV-MAMA instrument using the F25SRF2 filter, in order to observe the H2 Lyman and Werner emission whilst removing contamination from the geocoronal Lyman-alpha. Jupiter will be positioned such that only the auroral

region and nearby disc will be in the 25x25" field of view, and thus <1/4 of the detector is filled with the planet. We will obtain ~2400 s time-tagged exposures, from which images integrated over smaller intervals (e.g. 10-100 s) will be extracted. POS_ANG parameters will be provided in a timely manner. They depend on the exact observing time and ORIENT angle and are such that STIS MAMA repeller wire does not cross the auroral region.

Visit

Proposal 16118, Visit 01, implementation

Wed Sep 01 15:00:15 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: SCHED 40%

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	JUPITER-AURORA-WITH-CHANDRA	STD=JUPITER	TYPE=POS_ANGLE,RAD=25,ANG=25,REF=NORTH		CML OF JUPITER FROM EARTH BETWEEN 120 220, NOT OCC OF JUPITER-AURORA-WITH-CHANDRA BY JUPITER FROM EARTH	EARTH

Comments: For the purposes of the Phase 2 form I have included placeholder values for the position angle and radius for a given time (chosen arbitrarily for 8 Nov 2020 to ensure that Jupiter was in view for tool checks). However, the actual position angle and radius will depend on the date and time of the observation, which in turn will depend on the schedulability of both Chandra and HST. We can provide updated position angles and radii for a more suitable window once schedulability is determined for both spacecraft.
Description=JUPITER NORTH AURORA

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Jupiter Aurora Obs with CXO (STIS.im.733411)	(1) JUPITER-AURORA-WITH-CHANDRA	STIS/FUV-MAMA, TIME-TAG, F25SRF2	MIRROR	BUFFER-TIME=99			2554 Secs (2163 Secs) *[==>2163.0 Secs]*	*[1]*

Comments: We again note that the precise date and time of the observation will be determined from schedulability of Chandra and HST together, so that some of these parameters may be prone to change, when the observation date-time is better constrained.

Orbit Structure