Spatial Variability: System III & System IV Longitude, Local Time, Io Phase

1992 – green colored date means also included under UV emissions bibliography
1982 – blue colored date means also included under physical chemistry model bibliography
1982 – red colored date means also included in GB & cold torus bibliography

Date	Authors, title, reference	UV/Vis/IR Atomic Database	Summary
1980	Trauger, Munch, Roesler, A study of the jovian [S II] nebula at high spectral resolution, *Ap. J., 236*, 1035-1080		
1982a	Sandel, Broadfoot, Discovery of an Io-correlated energy source for Io's hot plasma torus, JGR, 87, 2231		All UVS data from V1+V2 (44 days). Just 685 A (SIII+OIII) Variation in brightness with phase of Io. Peak at LT=19:00, SysIII comparison with GB observations
1982b	Sandel, Broadfoot, Io's hot plasma torus: A synoptic view from Voyager, JGR 87, 212		V1 in/outbound -> dusk brighter than dawn – 25% V2 3/8 cases where no dawn/dusk effect No system III effect
1982	Shemansky, Sandel, The injection of energy into the Io plasma torus, JGR, 87, 219-229		Te ~ constant for 0.5 yr with short-term variations. System III variations in Te. Energy balance using primarily SIII 685A Te hotter LT= 22:30 dusk vs 10:30 dawn e- heating: ion collisional heating too slow (6-10d). Fehot <1% (Scudder 1981, Shamansky 1980)
1984	Trauger, The jovian nebula: A post-Voyager perspective, *Science, 226*, 337-341		
1988	Sandel, Dessler, Dual periodicity of the jovian magnetosphere, *JGR, 93,* 5487		Confined to SIII – looking for System III & IV variations. (pity in hind sight given later work showing SI and SIV more) 42 days of V2 data (235 scans). Also nKOM Lots of ideas – not any solid conclusions

1992	Dessler, Sandel, System III variations in apparent distance of the Io plasma torus from Jupiter, *GRL, 19,* 2099		Looking at location of peak emission – varying in distance from Jupiter (0.1-0.2 RJ) – different for dawn & dusk – driven by tail flows (IG, BK) but why modulated by System III? When modified for 0.12 RJ offset of OTD the modulation on dawn disappears – but not dusk.
1992	Thomas, Optical observations of Io's neutral clouds and plasma torus, *Surveys Geophys., 13,* 91-164		
1993	Thomas, Detection of [OIII] 5007 emission from the Io plasma torus, *Ap. J., 414*, L41-L44		
1993	Thomas, The variability of the Io plasma torus, *JGR, 98,* 18,737-18,750		
1996	Thomas, High resolution spectra of Io's neutral potassium and oxygen clouds, *Astron. Astrophys., 313,* 306-314		
1997	Brown, Bouchez, The response of Jupiter's magnetosphere to an outburst on Io, *Science, 278*, 268-271		
1997a	Volwerk, et al. Evidence for short cooling time in the Io plasma torus. *GRL, 25,* 1147-1150	COREQ	If there is a lack of correlation between dawn-dusk ansas in brightness then there must be a <~2 hr cooling time. This requires high density (10,000) and question about source of electron heating.

1997b	Volwerk, Systems III and IV modulation of the Io phase effect in the Io plasma torus, *JGR, A11,* 24, 403-24,410	COREQ	System III & IV modulation of the Io phase effect (~30%). Cleaner at dawn (where dimmer, farther) than at dusk (brighter, closer). Maybe part of problem is that SIII emissions (less variable) dominate the total brightness.
2000	Herbert, Sandel, Azimuthal variation of ion density and electron temperature in the Io plasma torus, *JGR, 105,* 16035-16052	COREQ	Azimuthal variations in density and Te. 47 huors of V1 data. Empirical fits to System III, IV, LT, IPE functions of brightness. Explained as Birkeland currents.
2001	Lichtenberg, Thomas, Fouchet, Detection of S(IV) 10.51 micron emission from the Io plasma torus, *JGR, 106,* 29,899-29,910		
2001	Oliversen, et al., Sunlit Io atmospheric [OI] 6300 A emission and the plasma torus, *JGR, 106,* 26,183-26,193		
2001	Thomas, Lichtenberg, Scotto, High-resolution spectroscopy of the Io plasma torus during the Galileo mission, *JGR, 106,* 26,277-26,291		Spectrally resolved SII, SIII, OII, OIII (upper limit) Sept 1997 and Oct 1999 Extensive exploration of Tperp and Vco vs radial distance Matched with S+/Ne~13%, S++/Ne~14%, O+/Ne~15%, O++/Ne<1.1%
2005	Delamere, Steffl, Bagenal, Modeling temporal variability of plasma conditions in the Io torus during the Cassini era, *J. Geophys. Res., 109,* A10216	CHIANTI	Dust measurements show x1000 increase in flux from Io in Sept 2000 Cassini UVIS sees decrease from Oct 2000 through Mar 2001. Modeled with 2003 model with factor of 3.5 increase in neutral production rate with time-scale of 22.5 days. No evidence of O/S different from 2.
2004	Nozawa et al., Long-term SII emissions from the Io plasma torus between 1997 and 2000, *JGR, 109,* A07209		4 observing periods during S+ emission during Galileo epoch 1 - C9 – 1997 doy 240-252 (Aug26-Sep9) 2 - E16-1998 doy 235-270 (Aug23-Sep27) 3 - C23-1999 doy 250-265 (Sep7-Sep22) 4 - G28-2000-1 doy 350-372 (Dec16-Jan7) Steady decrease in intensity by a factor of ~2

2005	Nozawa et al., Relationship between the jovian magnetic plasma density and the Io torus emission, *GRL, 32,* L11101		Relates above observations to factor of ~8 decrease in electron density 30-60 RJ observed by the GLL-PWS instrument. Note that the Cassini flyby dust increase (~Aug 2000) followed by decrease in UV torus emissions was Oct 1-Dec1 2000 (see Delamere 2005) between observation periods 3 and 4.
2006	Steffl, Bagenal, Stewart, Cassini UVIS observations of the Io plasma torus. III: Observations of temporal and azimuthal variability, *Icarus, 180,* 124-140	CHIANTI 4.2	System III & IV. 4 pages of review. Weak variation in O+ and S++. Strong variations in S+ and S+++ anticorrelated Periodogram
2006	Steffl, Bagenal, Stewart, Cassini UVIS observations of the Io plasma torus. IV: Modeling temporal and azimuthal variability, *Icarus, 180,* 124-140	CHIANTI 4.2	System III &IV. Fit functions to system III and IV variations – modulation of electrons Table of production and loss lifetimes for different species via different processes Role of hot electrons
2006	Nozawa et al., Implications for the solar wind effect on the Io plasma torus, *GRL, 33,* L16103		S+ emission observed Sept 1998. 2 points of enhanced emission in late Sept (DOY 267-9). Argued related to QP radio bursts (Morioka 2006) and auroral flares (Waite 2001).
2010	Yoneda, Nozowa, Misawa, Kagitani, Okano, Jupiter's magnetospheric change by Io's volcanoes, *GRL, 37,* L11202		Na and S+ emissions for 20 days in 2003. Enhancement late Feb – early Mar for few days. Factor 2 increase in Na emission for 2 days. Total fluxtube content of S+ increased by ~25%
2015	Tsuchiya et al., Local electron heating in the Io plasma torus associated with Io from the Hisaki satellite observation, *JGR, 120,* 10,317-10,333	CHIANTI 7.1.4	EXCEED data end Dec 2013 – mid Jan 2014 (~25 days) 2 lines each for SII, SIII, SIV, Dawn & Dusk. Periodogram picks up System III, IV, Io period. Io phase effect. Longitude explained as Io moving up & down relative to center of torus Big difference in System III effect for dawn vs. dusk (like Dessler, Sandel) Io phase effect shows peak emission just before Io reaches elongation – suggested due to hot electrons in tail – needs about 140 GW of power into the electrons to produce a 10% modulation 12-40% effect

2015	Yoneda, Kagitani, Tsuchiya, Sakanoi, Okano, Brightening event seen in observations of Jupiter's extended sodium nebula, *Icarus, 261*, 31-33		Na observations 2013-2015. Faint emissions except Feb-Mar 2015 when enhanced by a factor of 3
2016	Murakami et al., Response of Jupiter's inner magnetosphere to the solar wind derived from extreme ultraviolet monitoring of the Io plasma torus, *Geophys.*	CHIANTI 8.0	Hisaki Dawn-dusk variability Dec 2013 – Mar 2014. Compared with model-based extrapolation of SW dynamic pressure from 1 AU.
2017	Yoshikawa, I., et al., Volcanic activity on Io and its influence on the dynamics of the Jovian magnetosphere observed by EXCEED/Hisaki in 2015, *Earth,*	CHIANTI 7.1.3	Hisaki data 2015 DOY -35 to +90 – includes beginning of Io eruption Compare IPT emissions, auroral power, SW dynamic pressure. Argues for electron injection events enhanced by volcanic activity
2018	Koga, R. et al., The time variation of atomic oxygen emission around Io during a volcanic event observed with Hisaki/EXCEED, *Icarus, 299*, 300–307	CHIANTI 8.0	Hisaki 2014 DOY -20 to +115, 2015 -35 to +135 Atomic OI (130.4nm) compared with GB NaI Io eruption 2015 DOY 20-100