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STIS/CCD VARIABLE FRINGING NEAR 9750Å

John C. Martin (U of Minnesota)

(If you use information or advice from this memo, please acknowledge it and the net site <http://etacar.umn.edu/> in any resulting publications; thanks)

1. Introduction

The STIS uses a thin backside illuminated CCD which is prone to significant fringing redward of 7500Å (Kim Quijano et al., 2003)¹. Under most circumstances the STIS/CCD has been calibrated to remove this effect (Malumuth, 1996; Goudfrooij et al., 1998; Malumuth et al., 2003). However, there are additional transient fringing effects which remain unmodeled. Those effect presumably occur due to small changes in the shape and orientation of the CCD because the front and back surfaces are not perfectly coplanar (i.e. Fig 2. in Goudfrooij et al. (1998)). The STIS instrument development team recommended that fringe flats be taken with all long wavelength CCD observations. However to eliminate overhead time and maximize scientific return in a limited number of orbits most STIS users, including the Treasury Project, ignored the IDT's advice.

Fortunately, we have encountered only one case where STIS/CCD fringing has a significant averse affect on the Treasury Product data. This transient fringing is confined to a region approximately 150Å wide near 9750Å. However, it is significant and since it unpredictably appears and disappears it could potentially be misinterpreted by the unwary and unformed.

2. The Fringes Near 9750Å

Strong variable fringing occurs in the STIS/CCD spectra near 9750Å. It was present in only five of the twenty five spectra exposed by the Treasury Project with the G750M 9851Å grating tilt (see Figure 2., Table 1). It is present only in the spectrum of the central star (presumably because the extended material does not have a bright continuum). The “feature” is not present in VLT/UVES spectra of the central star taken approximately at the same time. One of those spectra, taken on MJD 52812.1 corresponds with Eta Carinae's 2003.5 spectroscopic event. *All indications are that the appearance of the fringes at that time was purely coincidental. Do not mistake this for a scientific result!*

The variable fringing is only observed in spectra taken with the G750M grating and is not present in the same wavelength range of observations with the G750L grating. Only four non-Treasury Project STIS/CCD observations were made with the G750M

¹http://www.stsci.edu/hst/stis/documents/handbooks/currentIHB/c07_performance2.html#371587

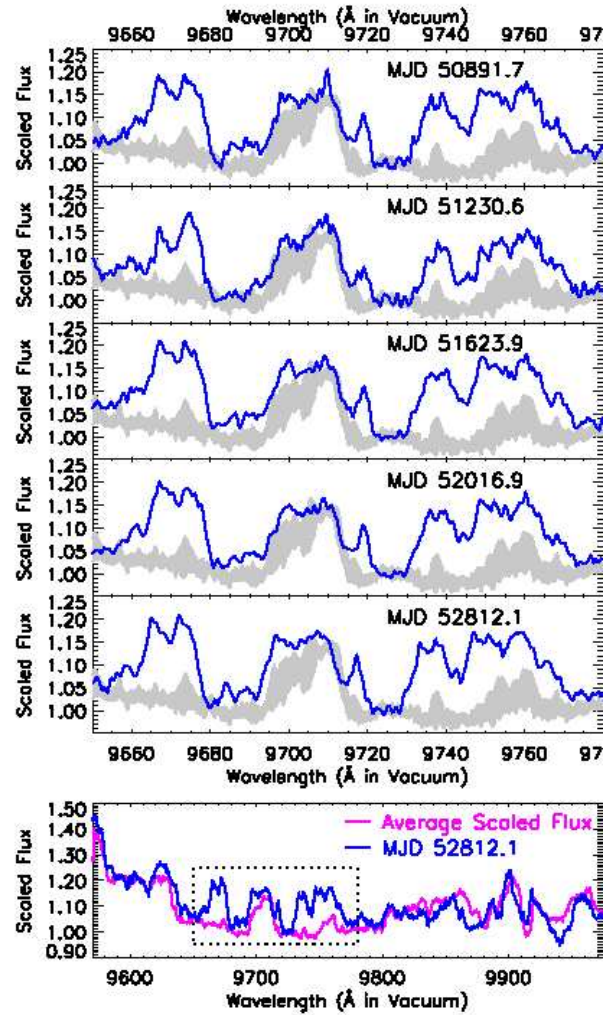


Figure 1: In the top five panels, the spectra for each date is plotted as a solid line. The gray envelope is the range of scaled fluxes observed in the spectra at the epochs when the fringing was *not* present. The bottom panel is a plot of the greater spectral region for reference.

Table 1: STIS/CCD G750M 9851Å Grating Tilt Spectra

TP Data Number	Root Name	MJD	Target	Slit	Angle (deg)	Grating	Central Wave Å	Exp Time (sec)
Treasury Project Spectra With Variable Fringing								
c821_0350	o4j801160	50891.7	Central Star	52X0.1	-28	G750M	9851	12.0
c914_0300	o556020u0	51230.6	Central Star	52X0.1	-28	G750M	9851	10.0
cA22_0270	o5kz010r0	51623.9	Central Star	52X0.1	-28	G750M	9851	17.0
cB29_0260	o62r010q0	52016.9	Central Star	52X0.1	+22	G750M	9851	17.0
cD47_0030	o8gm63030	52812.1	Central Star	52X0.1	+70	G750M	9851	15.0
Other HST Spectra With Variable Fringing								
	o4a5050g0	50734.9	BD+75 325	52x2	-120	G750M	9851	72.0
	o5i008070	51573.8	G19B2B	52x2	+62	G750M	9851	480.0
	o6ig080i0	52177.1	G19B2B	52x2	-147	G750M	9851	690.0
Treasury Project Spectra Without Variable Fringing								
cA20_0080	o5f102080	51616.5	Sr Region	52X0.2F1	-42	G750M	9851	167.0
cB75_0070	o6ex03070	52183.1	Central Star	52X0.1	+165	G750M	9851	12.0
cB90_0180	o62r020i0	52240.2	Sr Region	52X0.2	-131	G750M	9851	200.0
cC05_0260	o6ex020q0	52294.1	Central Star	52X0.1	-82	G750M	9851	15.0
cC51_0480	o6mo021c0	52459.7	Weigelt Knots	52X0.1	+69	G750M	9851	15.0
cD12_0260	o8gm120q0	52683.0	Central Star	52X0.1	-57	G750M	9851	15.0
cD24_0120	o8gm210c0	52727.3	Central Star	52X0.1	-28	G750M	9851	15.0
cD34_0120	o8gm410c0	52764.3	Central Star	52X0.1	27	G750M	9851	15.0
cD37_0120	o8gm330c0	52776.5	Weigelt Knots	52X0.1	+38	G750M	9851	15.0
cD37_0130	o8gm330d0	52776.5	Central Star	52X0.1	+38	G750M	9851	15.0
cD41_0480	o8gm521c0	52791.9	Central Star	52X0.1	+62	G750M	9851	15.0
cD41_0490	o8gm521d0	52791.9	Weigelt Knots	52X0.1	+62	G750M	9851	15.0
cD47_0020	o8gm63020	52812.1	Weigelt Knots	52X0.1	+70	G750M	9851	15.0
cD51_0200	o8ma720k0	52825.5	Weigelt Knots	52X0.1	+69	G750M	9851	15.0
cD51_0210	o8ma720l0	52825.5	Central Star	52X0.1	+69	G750M	9851	15.0
cD58_0500	o8ma821f0	52852.3	Central Star	52X0.1	+105	G750M	9851	15.0
cD58_0510	o8ma821g0	52852.4	Weigelt Knots	52X0.1	+105	G750M	9851	15.0
cD72_0270	o8ma920r0	52904.4	Central Star	52X0.1	+153	G750M	9851	15.0
cD88_0120	o8ma830c0	52960.6	Central Star	52X0.1	-142	G750M	9851	15.0
cE18_0210	o8ma940l0	53071.3	Central Star	52X0.1	-28	G750M	9851	15.0
Other HST Spectra Without Variable Fringing								
	o4g8020c0	50853.9	α CMi B	52x0.2	+0	G750M	9851	120.0

9851Å grating tilt (Table 1). Of those four, three have the variable 9750Å fringing pattern.

The appearance and disappearance of the 9705Å fringing does not correlate with any obvious factors. However, we must acknowledge that is hard to determine since we are dealing with only twenty nine observations over the entire six year lifetime of the STIS (over 85% of which are observations of Eta Car, which is a very unique object on its own). We are also fairly certain the fringing is not associated with a secondary light leak in the blocking filter since there was no significant change in Eta Car's spectrum near 4830Å when the fringing occurred. Unfortunately, there is no working model to remove or correct for this or other transient fringing in STIS/CCD data.

References

- Goodfrooij, P. et al. 1998, "STIS Near IR Fringing II. Basics and Use of Contemporaneous Flats for Spectroscopy of Point Sources," STIS Instrument Science Report 98-19, (Baltimore: STScI)
- Kim Quijano, J., et al. 2003, "STIS Instrument Handbook", Version 7.0, (Baltimore: STScI)
- Malumuth, E. M. 1996, "Reflections on STIS CCD Fringing," STIS IDT Analysis Report 85, (Greenbelt: NASA Goddard)
- Malumuth, E. M., et al. 2003, PASP, 115, 218