The Final IUE Archive, Science Fiction, and Potential Hazards.

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On several previous occasions, a word of caution about misinterpreting IUE data, or reading unwarranted significance into artifacts that appear in IUE spectra, have been pointed out, e.g. in the IUE Newsletter #26 (Imhoff & Grady 1985). These errors were primarily attributed to hot pixels and radiation hits that can mimic emission lines, and reseau marks that can be confused with absorption features. In this note, I would like to give a different example for potential hazards of misinterpreting IUE data in regard to the coming final archiving, particularly with respect to the time after the active observing phase of IUE when future astronomers will use the data without the benefit of 14+ years of hands-on practical observing experience.

Recently, I was asked by an old friend (a very competent retired non-astronomical spectroscopist with an interest in cosmology, but without familiarity of IUE data), to provide some IUE spectra of galaxies. The Merged Log of Observations lists numerous low-dispersion observations of the Seyfert 2 galaxy NGC 1068, so it seemed to be a good candidate. (I hasten to add that AGNs lie outside my personal field of expertise, but their strong emission lines are not unlike those of planetary nebulae or symbiotic stars with which I am more familiar). The Merged Log also revealed that most of the very long exposures (~400 minutes) were taken with the large aperture offset from the nucleus. The shorter exposures seem primarily to have been taken by European observers. Several things became immediately apparent:

1) The Merged Log for these European observations gives no information about offsets.
2) The Goddard copies of European scripts taken at Vilspa do not give this information either and are very sketchy.
3) There are no photowrite images of Vilspa observations at Goddard.

I chose what appeared to be a reasonable exposure of NGC 1068 (SWP 20349, 83 minutes, low-dispersion). A longer exposure (SWP 14360, 90 minutes) had C IV slightly saturated. To a first approximation, the spectrum of SWP 20349 looks perfectly reasonable and is almost identical to the somewhat longer SWP 14360 exposure, as shown in Figures 1 & 2. After mailing a copy of SWP 20349 to my friend, I received a phonecall from him a few days later. He was intrigued by the startling "discovery" that the

redshifts of the N V, C IV, He II, and C III] lines showed a monotonic decline! Was this a revolutionary discovery calling for a "new physics"? Clearly not. I remeasured the lines, using the standard RDAF procedure FEATURE and came up with the data shown in Figure 3, which obviously can't be true. A completely different result was obtained for SWP 14360, where the redshifts are much smaller and practically the same for the four lines in question, as they should be.

So what is the problem? Evidently the two exposures were centered on different portions of the galaxy, resulting in spurious velocities. Thanks to Fred Bruhweiler, a paper by Sniders, Briggs, & Boksenberg (1982) on NGC 1068 was located. In this paper a sketch is given which shows the aperture centered on the nucleus of NGC 1068 for SWP 14360 (as well as two others, off-center). Thus, the mystery was unravelled, although no information could be found for the orientation of SWP 20349, which evidently must have been offset from the nucleus so that different regions of NGC 1068 were sampled. However, without the knowledge of the specific circumstances of how these exposures were taken, which is not intuitively obvious from the Merged Log, scripts, and unavailability of photowrites, a future researcher would have a difficult time to decipher the erroneous message given by perfectly legitimate data. For such well-studied galaxies like NGC 1068 the problem is readily solved, but for more obscure objects there exists a great oppportunity for mischief and pure science fiction!

What to do? I would like to recommend strongly that the missing information mentioned above should be added to the final archive.

It may be worthwhile to point out once more the perhaps most troublesome hot pixels in high-dispersion spectra near λ1549 and λ1552: By the perversity of nature, the separation of these two is almost identical to the separation of the components of the C IV doublet, namely 2.6 A; In Figure 4 the section of the C IV lines in the planetary nebula IC 4997, as well as the hot pixels, are shown. For objects with complex P Cygni C IV lines the situation is a lot more complicated. In at least one IUE paper these hot pixels have been interpreted as "red-shifted emission components of C IV" attributed to an accretion disk.

References.

Imhoff, C.L., & Grady, C.A. 1985, IUE Newsletter #26, p.66, "Science Fiction With the IUE. I."

Snijders, M.A.J., Briggs, S.A., & Boksenberg, A. 1982, Third European IUE Conference, ESA-SP-176, 551.

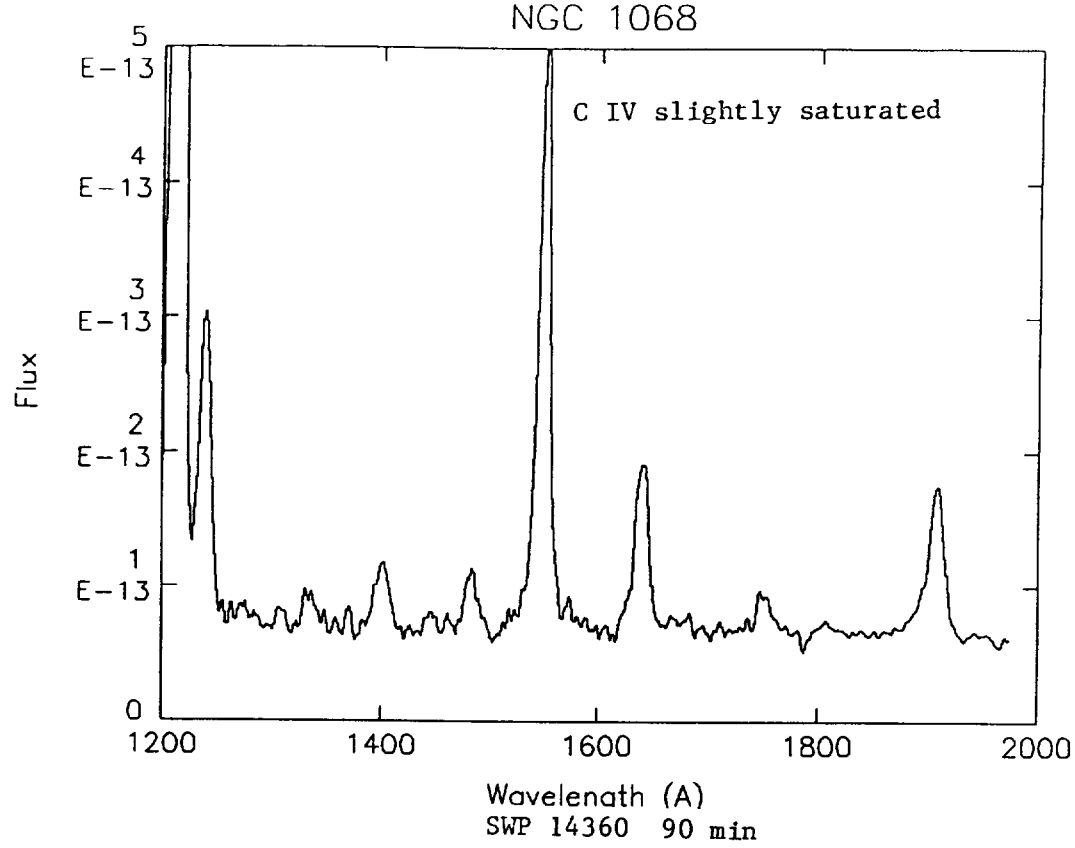
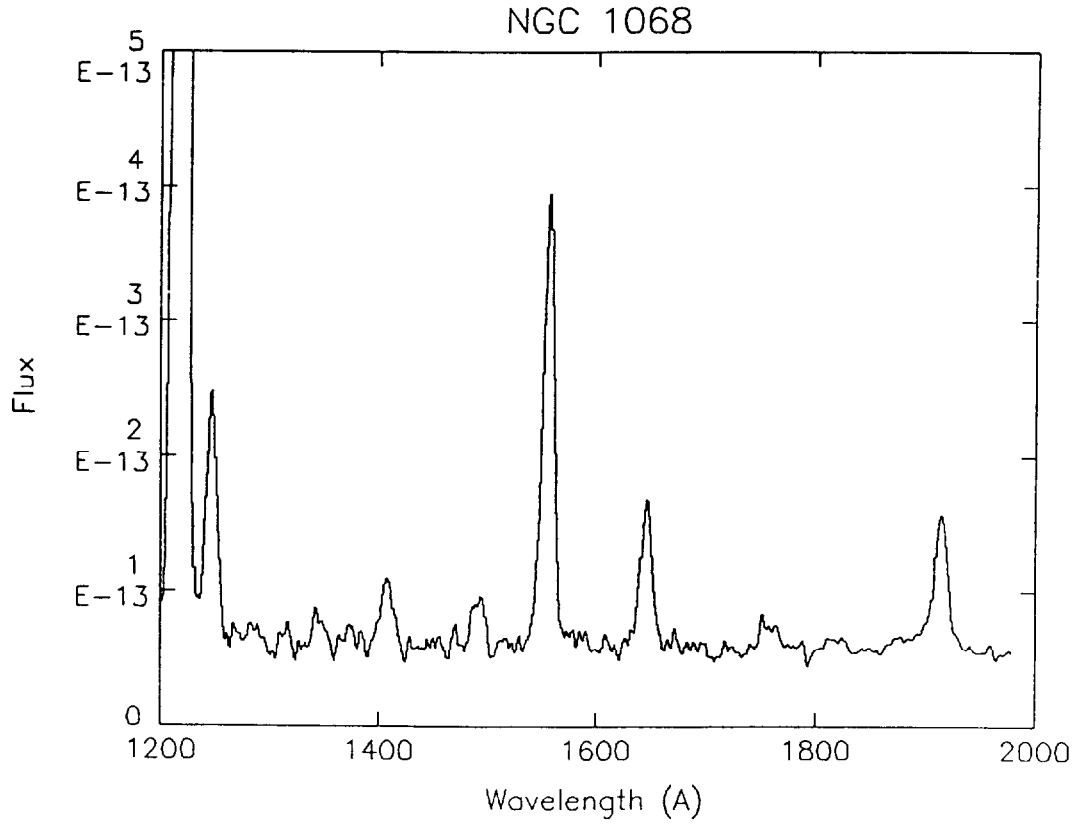


Fig.2



SWP 20349 83min

Fig.1

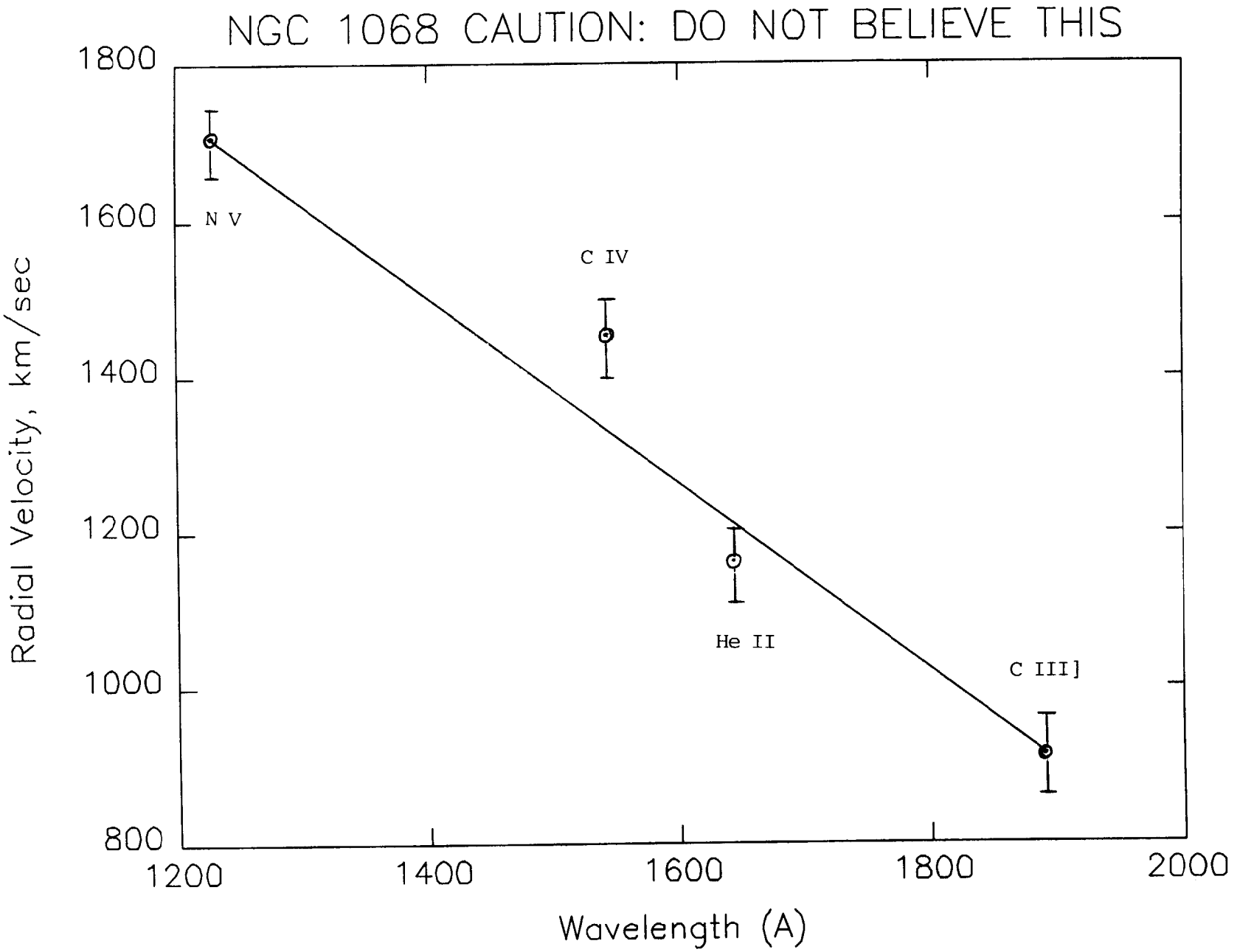

NGC 1068 CAUTION: DO NOT BELIEVE THIS
Radial Velocity, km/sec
1800
1600
1400
1200
1000
800
1200
1400
1600
1800
2000
Wavelength (A)
N V
C IV
He II
C III]

Fig.3.

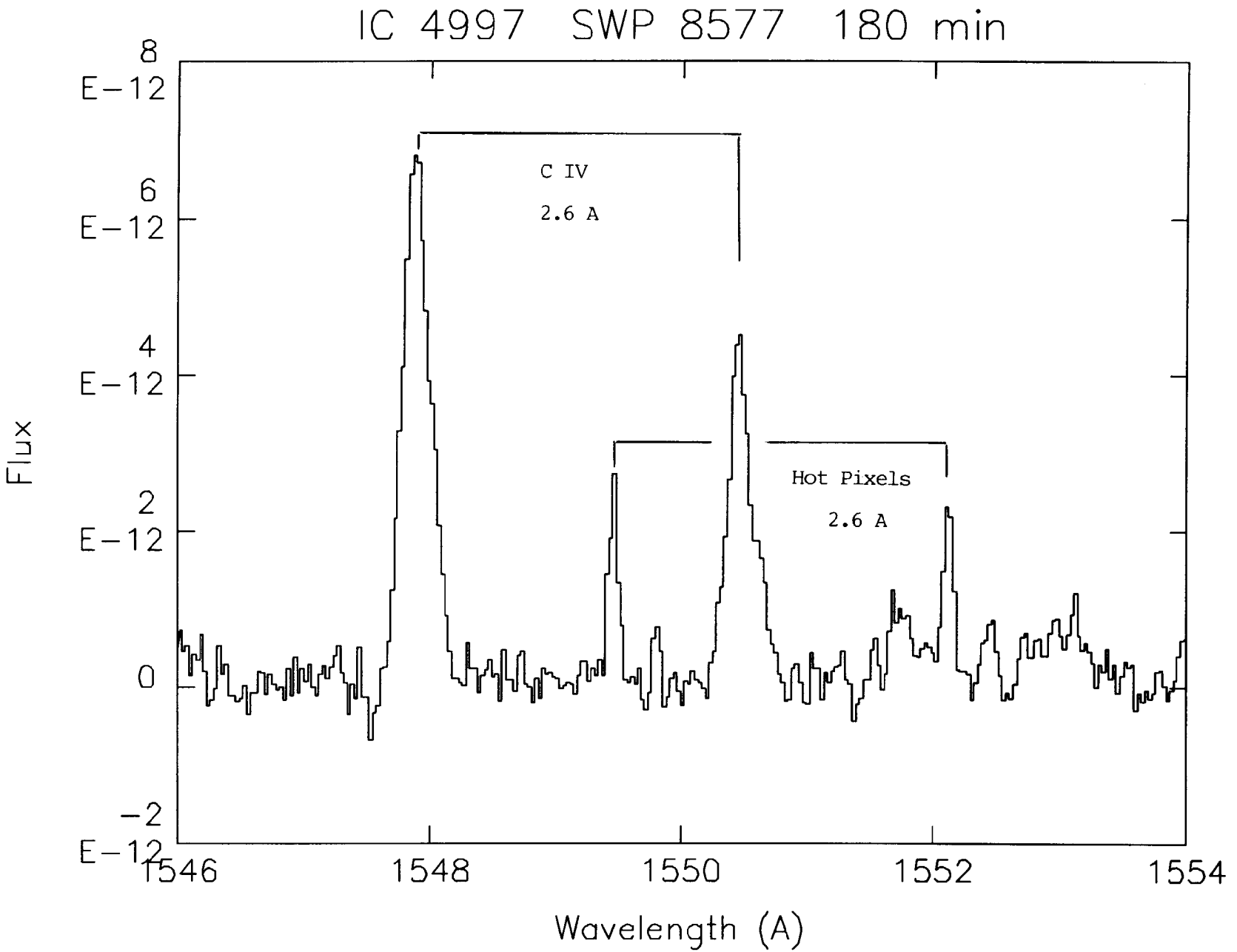

IC 4997 SWP 8577 180 min
8
E-12
6
E-12
4
E-12
2
E-12
0
-2
E-12
Flux
C IV
2.6 A
Hot Pixels
2.6 A
1546
1548
1550
1552
1554
Wavelength (A)

Fig. 4