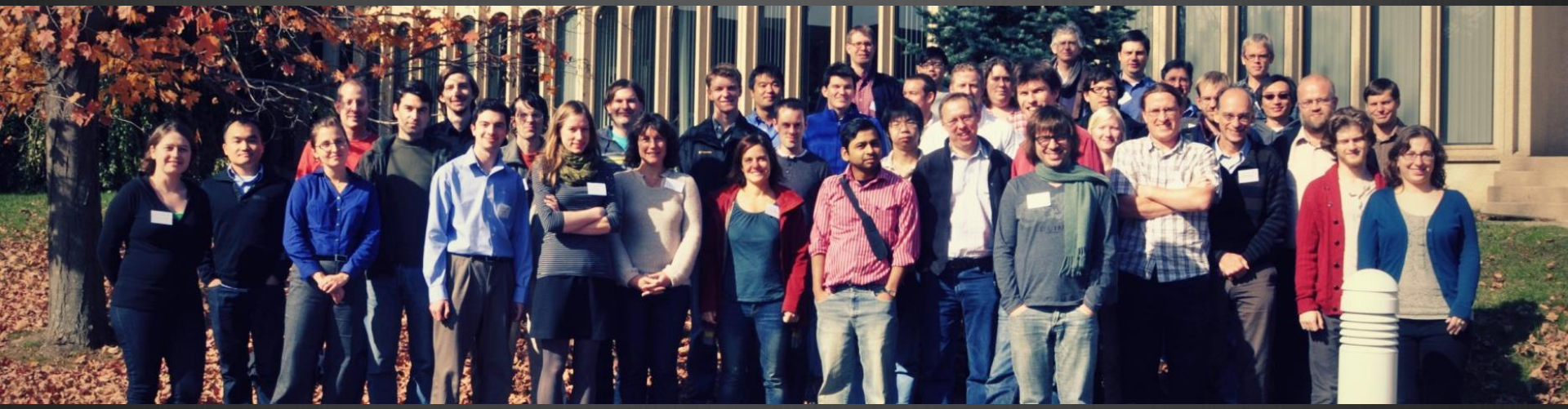
Kuazarların Değişen Rüzgar Yapıları

Nur Filiz Ak

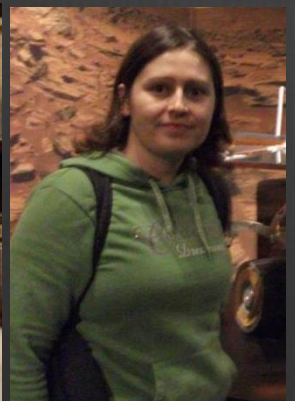
SDSS Kuazar Çalışma Grubu



Kuazar Rüzgarı Çalışma Ekibi

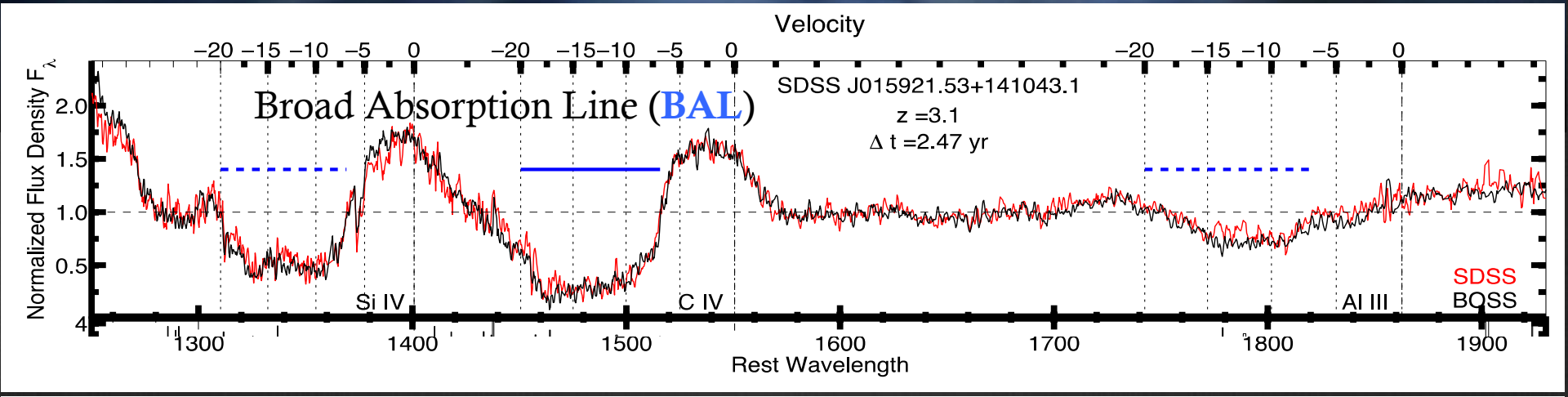
N. Brandt (PSU), P. Hall (York U.), Nur Filiz Ak (PSU), D. Schneider (PSU), P. Petitjean (UParis), I. Paris (Trieste), Yue Shen(China), F. Hamann(UF), J.Trump(Hubble), et al.






Kuazar Rüzgarları

Credit: NASA/CXC/M. Weiss, Niel Brandt,
Nur Filiz Ak, Nahks Tr'Ehnl

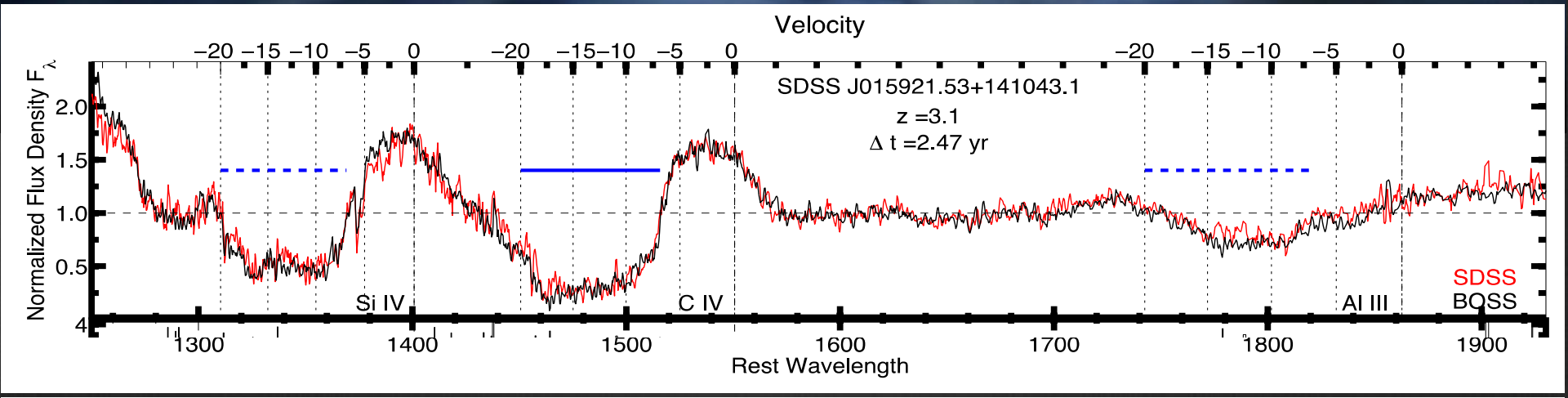


Kuazar Rüzgarları

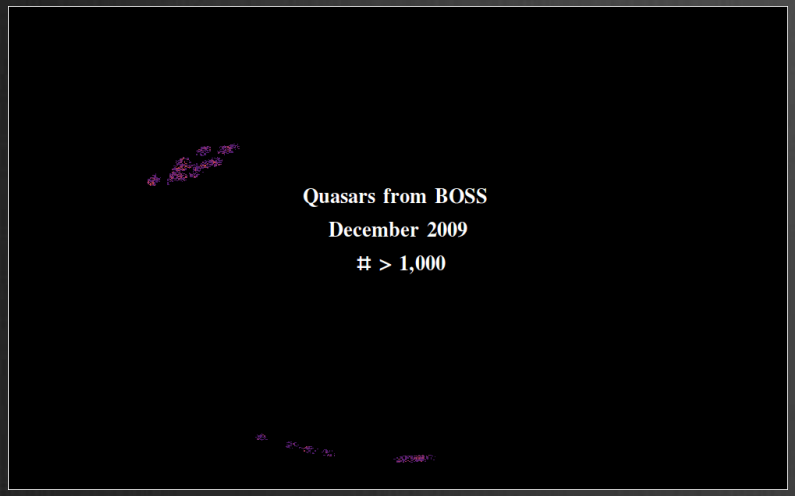
1. Açısal momentum kaybı
2. Host feedback -> yıldız oluşumu
3. Kuazar yapısının farklılaşması

Kuazar rüzgarları bu kadar önemliyse, neden sadece %15'inde BAL gözleniyor?

Credit: NASA/CXC/M. Weiss, Niel Brandt,
Nur Filiz Ak, Nahks Tr'Ehnl

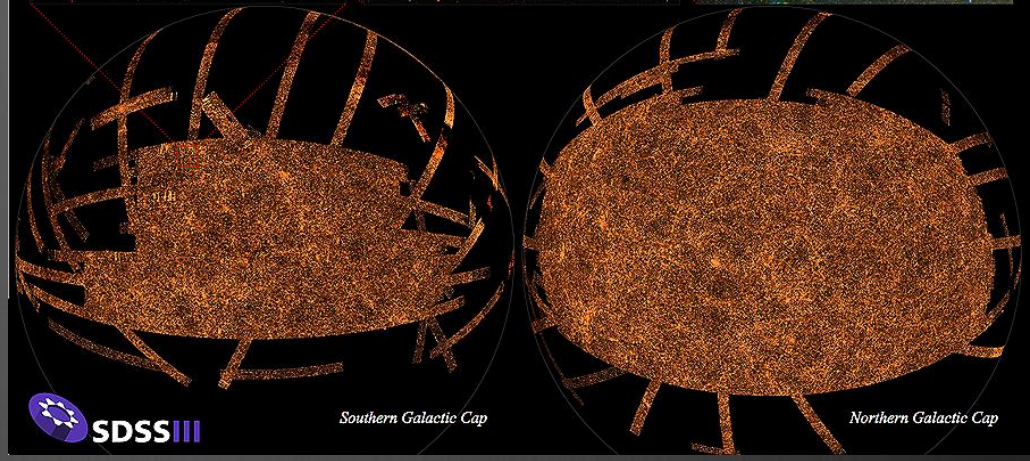


- BAL yapılarının yaygınlığı
- BAL yapılarının süreleri/yaşları
- Evrimsel süreçleri
- BAL oluşturan ve değişime neden olan süreçler
- Taşınan madde miktari
- Çoklu BAL yapıları
- Kaybolmasini sağlayan mekanizmalar



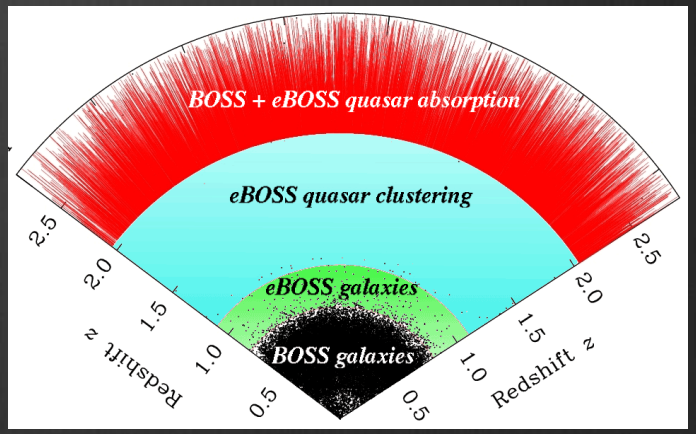
Credit: Franco Alberti

SDSS
BOSS



SDSS BOSS Ancillary Project 10 - A Large Scale Survey of Quasar BAL Variability with SDSSIII-BOSS

Aim: Move from single object/small-sample studies to large sample, high quality, and unbiased study of BAL variability over multi-year timescales.



1 - BAL Yapılarının Kaybolması

The Astrophysical Journal, 757:114 (19pp), 2012 October 1

Basın Duyurusu yapıldı

BROAD ABSORPTION LINE DISAPPEARANCE ON MULTI-YEAR TIMESCALES IN A LARGE QUASAR SAMPLE

N. Filiz Ak[1,2,3], W. N. Brandt[1,2], P. B. Hall[4], D. P. Schneider[1,2], S. F. Anderson[5], R. R. Gibson[5], B. F. Lundgren[6], A. D. Myers[7], P. Petitjean[8], Nicholas P. Ross[9], Yue Shen[10], D. G. York[11], D. Bizyaev[12], J. Brinkmann[12], E. Malanushenko[12], D. J. Oravetz[12], K. Pan[12], A. E. Simmons[12], and B. A. Weaver[13]
[1] Department of Astronomy & Astrophysics, Pennsylvania State University, University Park, PA 16802, USA; nfilizak@astro.psu.edu

SDSS Young Astronomer Award !
ZDaniels Award !

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October 1, 2012

Gone, with the Wind

http://www.sdss3.org/press/thewind.php

The case of the missing quasar gas clouds has been solved by a worldwide team of astronomers, and the answer is blowin' in the wind.

Astronomers Nurten Filiz Ak and Niel Brandt of the Pennsylvania State University led the team, which announced their results in a paper published in today's issue of *The Astrophysical Journal*. The paper describes 19 distant quasars in which giant clouds of gas seemed to disappear in just a few years.

1 - BAL Yapılarının Kaybolması

Basın Duyurusu yapıldı

THE ASTROPHYSICAL JOURNAL, 757:114 (19pp), 2012 Oct

BROAD ABSORPTION LI TIMESCALES IN

N. FILIZ AK[1,2,3], W. N. BRANDT[1,2], P. B. R. GIBSON[5], B. F. LUNDGREN[6],
A. D. MYERS[7], P. PETITJEAN[8], NICHO ZYAEV[12], J. BRINKMANN[12],
E. MALANUSHENKO[12], D. B. A. WEAVER[13]
[1] Department of Astronomy & Astrophysic USA; nfilizak@astro.psu.edu

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October 1, 2012

org/press/thewind.ph

Gone, with the

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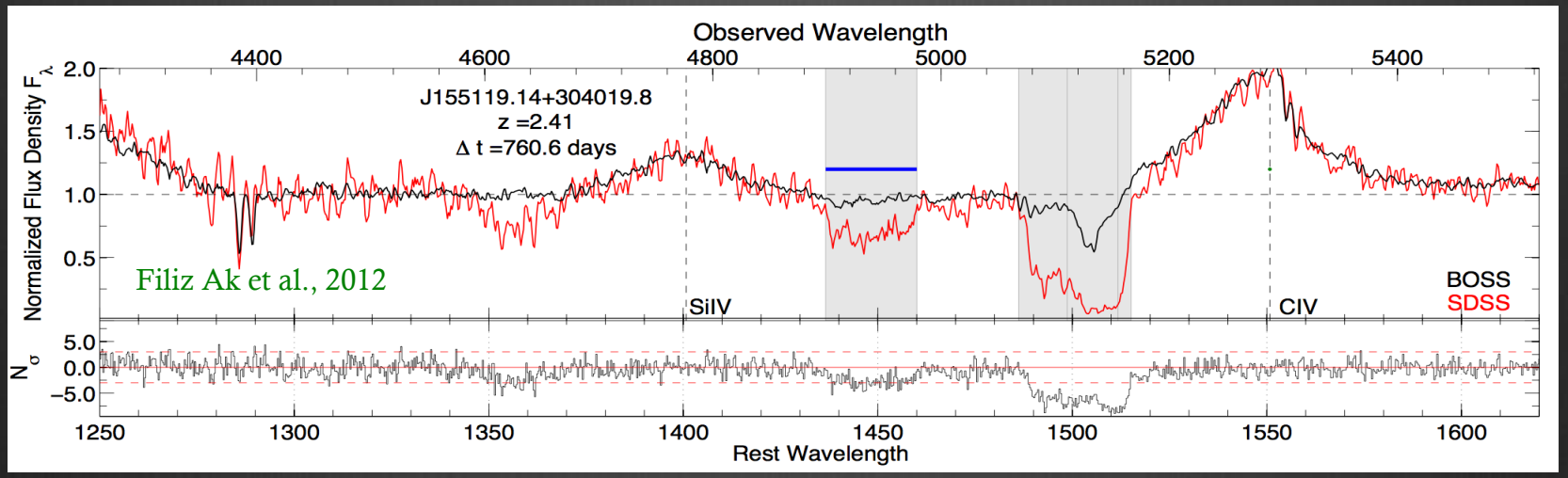
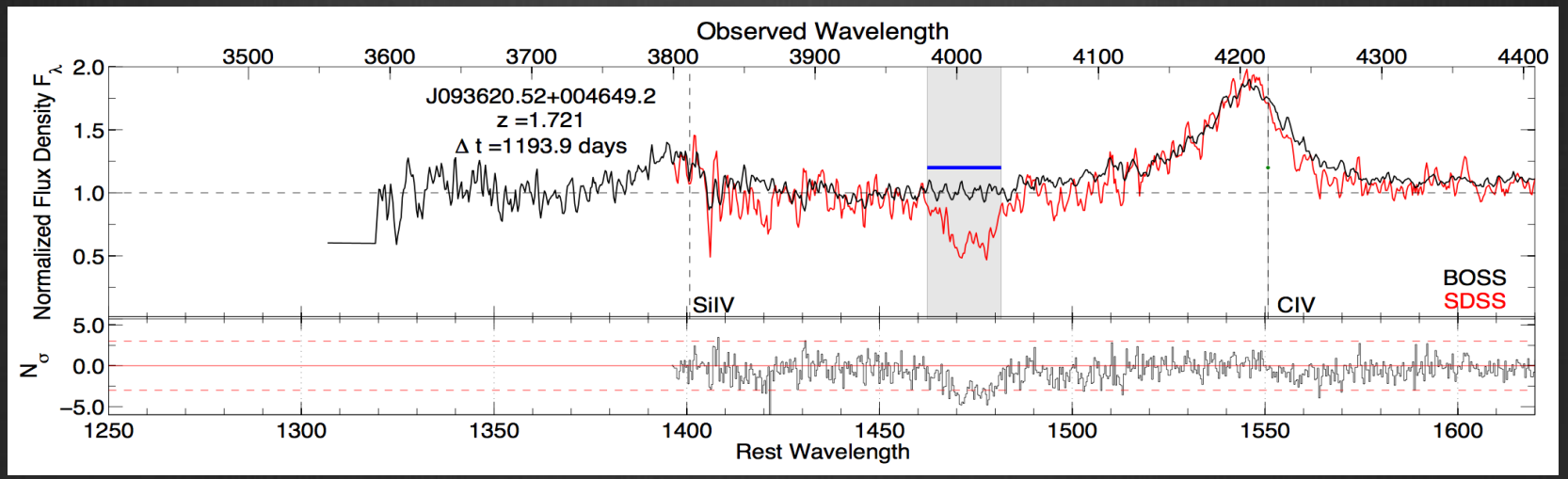
BAL Yapılarının Kaybolması

Disappearing C IV BAL Regions Marked in Blue





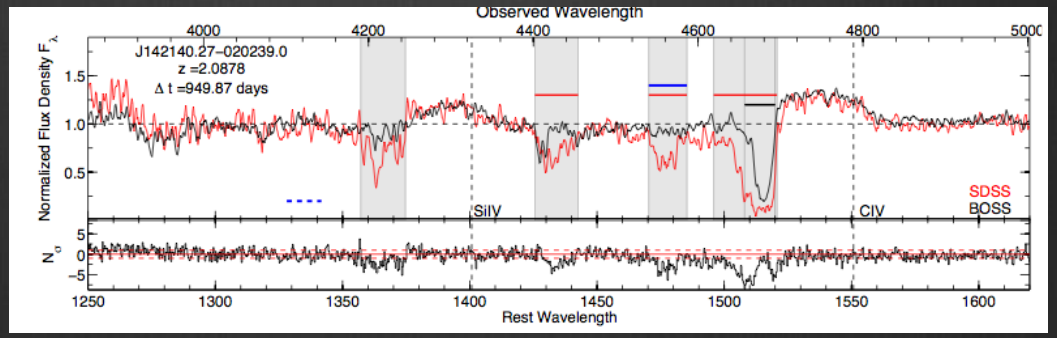
nfilizak@gmail.com

- **Ortalama 2.5 yılda**
- **19 kuasar tayfinda 21 BAL cizgisi kayboldu.**
- **10 kuasar BAL'dan non-BAL'a donustu.**

BAL Yapıları	• 2.3% (21/875)
Kuazarlar	• 3.3% (19/582)
Transformasyon	• 1.7% (10/582)

Transformasyonun ilk gözlemsel bulgusu

Çoklu BAL yapılarının koordine değişimi ilk kez gözlendi



2 - BAL Variability

The Astrophysical Journal, 777:168 (29pp), 2013 November 10 doi:10.1088/0004-637X/777/2/168

BROAD ABSORPTION LINE VARIABILITY ON MULTI-YEAR TIMESCALES IN A LARGE QUASAR SAMPLE

N. Filiz Ak[1,2,3], W. N. Brandt[1,2], P. B. Hall[4], D. P. Schneider[1,2], S. F. Anderson[5], F. Hamann[6], B. F. Lundgren[7,16], Adam D. Myers[8], I. Pâris[9], P. Petitjean[10], Nicholas P. Ross[11], Yue Shen[12,13,17], and Don York[14,15]

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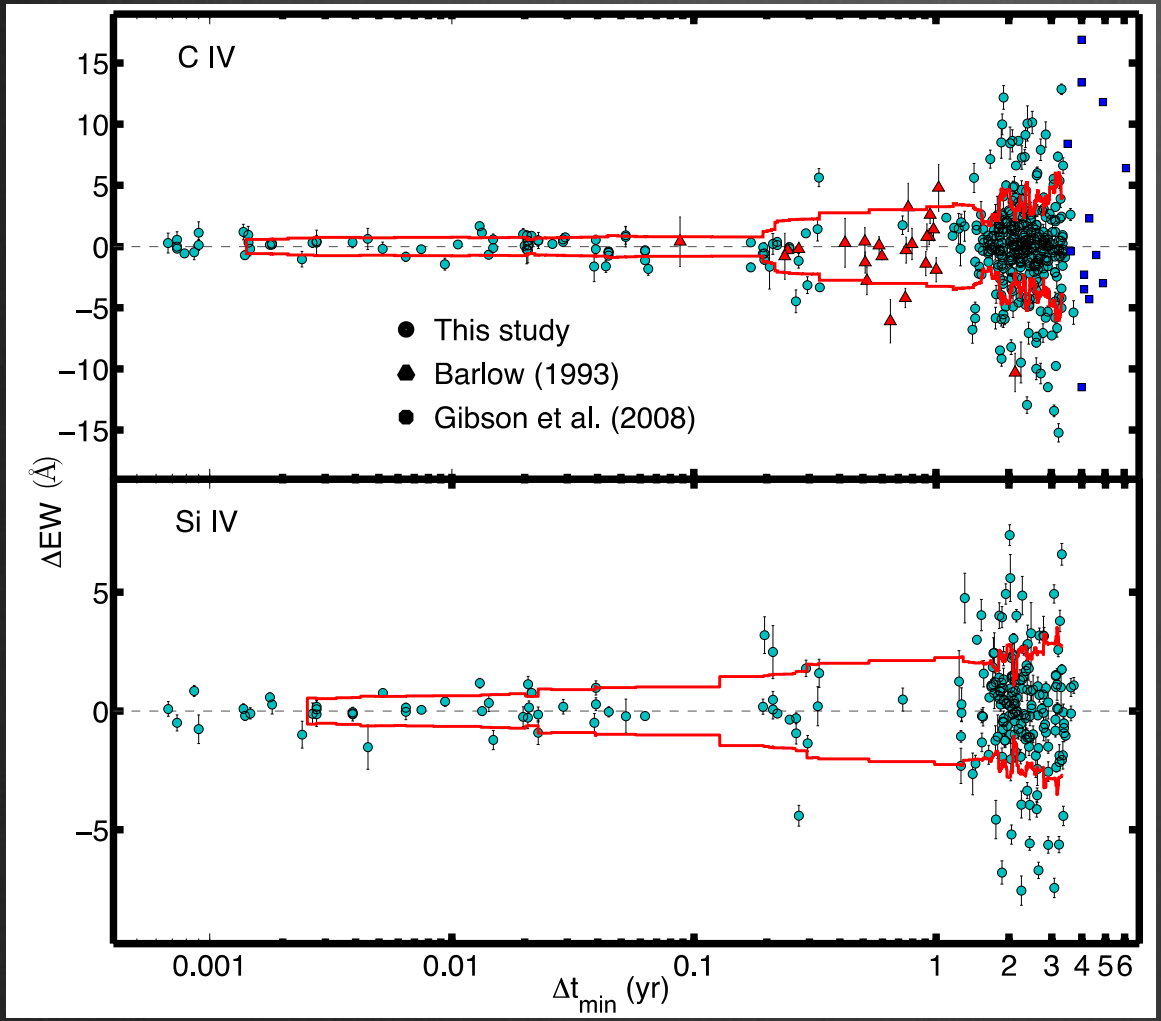
[3] Faculty of Sciences, Department of Astronomy and Space Sciences, Erciyes University, 38039 Kayseri, Turkey
[4] Department of Physics and Astronomy, York University, 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada
[5] Astronomy Department, University of Washington, Seattle, WA 98195, USA
[6] Department of Astronomy, University of Florida, Gainesville, FL 32611-2055, USA
[7] Department of Astronomy, University of Wisconsin, Madison, WI 53706, USA
[8] Department of Physics and Astronomy, University of Wyoming, Laramie, WY 82071, USA
[9] Departamento de Astronomía, Universidad de Chile, Casilla 36-D, Santiago, Chile
[10] Universite Paris 6, Institut d'Astrophysique de Paris, 75014, Paris, France
[11] Lawrence Berkeley National Laboratory, 1 Cyclotron Road, Berkeley, CA 92420, USA
[12] Harvard-Smithsonian Center for Astrophysics, 60 Garden St., MS-51, Cambridge, MA 02138, USA
[13] Carnegie Observatories, 813 Santa Barbara Street, Pasadena, CA 91101, USA
[14] The University of Chicago, Department of Astronomy and Astrophysics, Chicago, IL 60637, USA
[15] The University of Chicago, Enrico Fermi Institute, Chicago, IL 60637, USA
Received 2013 July 31; accepted 2013 September 19; published 2013 October 24

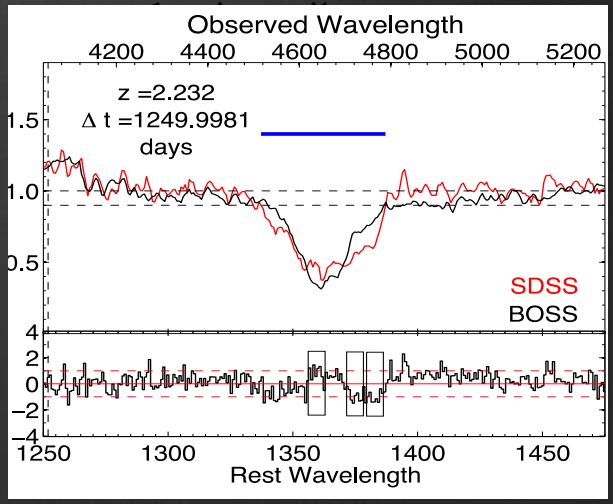
BAL Yapılarının Değişimi



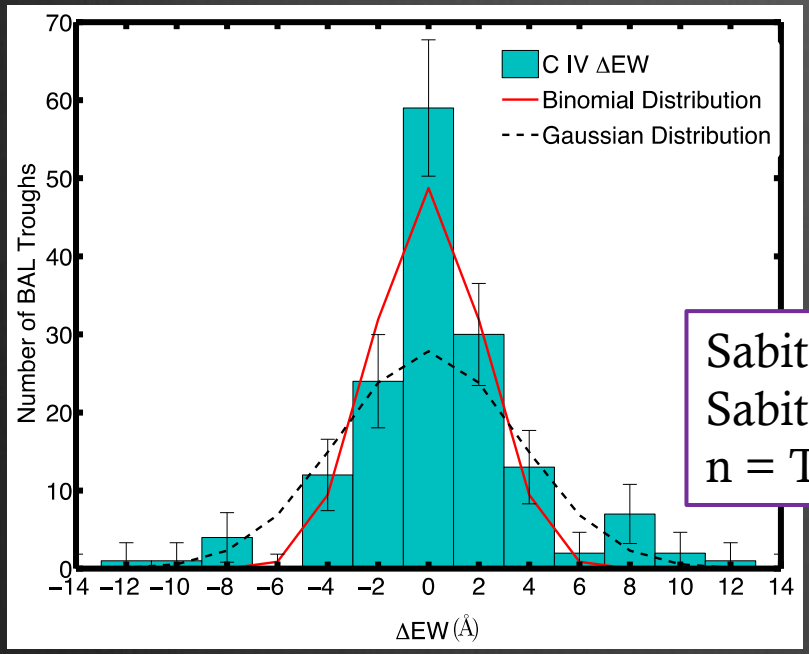
1. Değişim gösteren BAL yapılarının çok sayıda olması, BAL oluşumlarının karadelikten 10-100 ışık günü uzakta oluştuğunu gösteriyor.

2. BAL yapılarının ortalama ömrü, ilk kez hesaplandı, **birkaç bin yıl.**

3. BAL yapılarının kaybolmasını sağlayan mekanizma, değişimlere neden olan

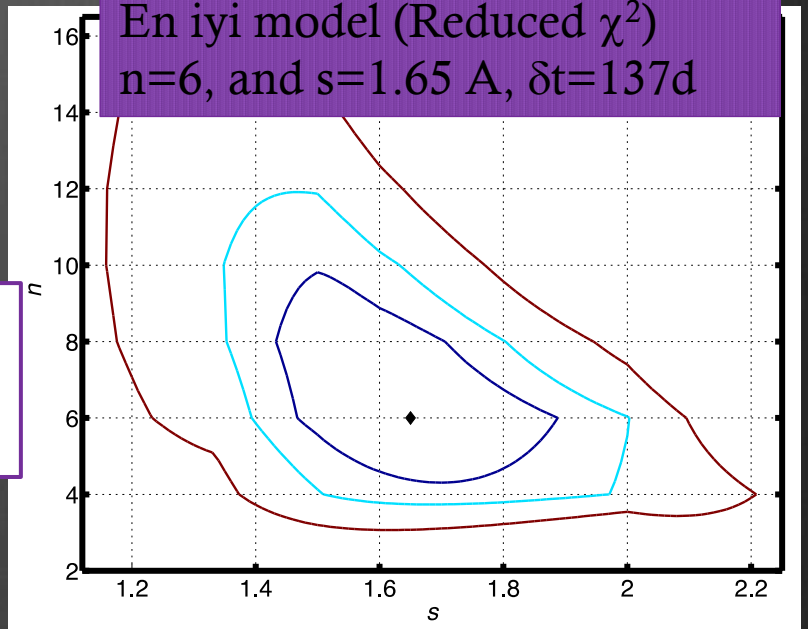


Random-Walk Model

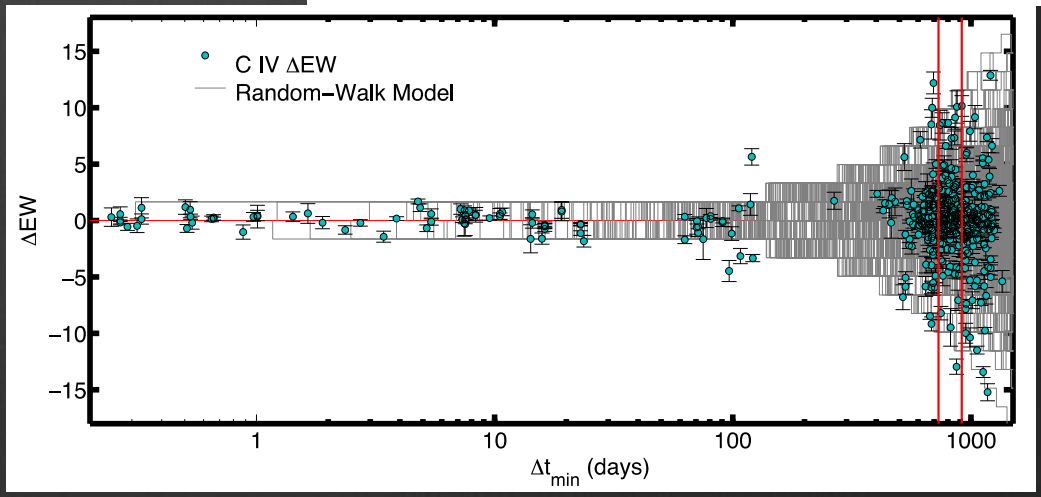


Sabit δEW
Sabit δt,
n = T/δt

En iyi model (Reduced χ^2)
n=6, and s=1.65 A, δt=137d



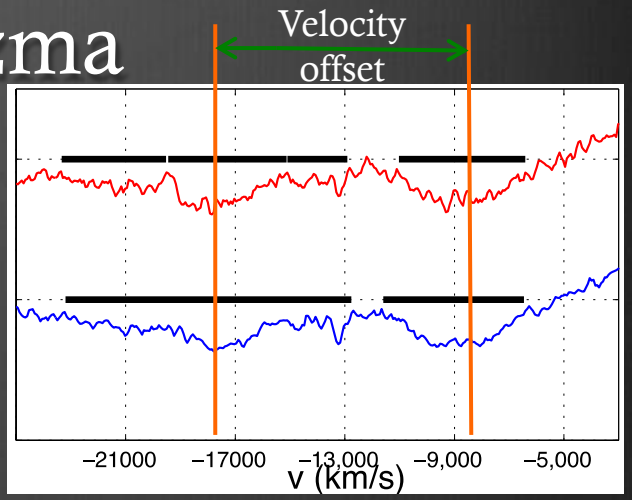
ΔEW dağılımı (2-2.5 yıl aralığında) binomial dağılımla uyumsuz değil (P~65%)



t=2-2.5 yıl için elde edilen model tüm zaman-ölçeklerini de temsil ediyor

Kuzar Rüzgarlarını (BAL Yapılarını) Değiştiren Mekanizma

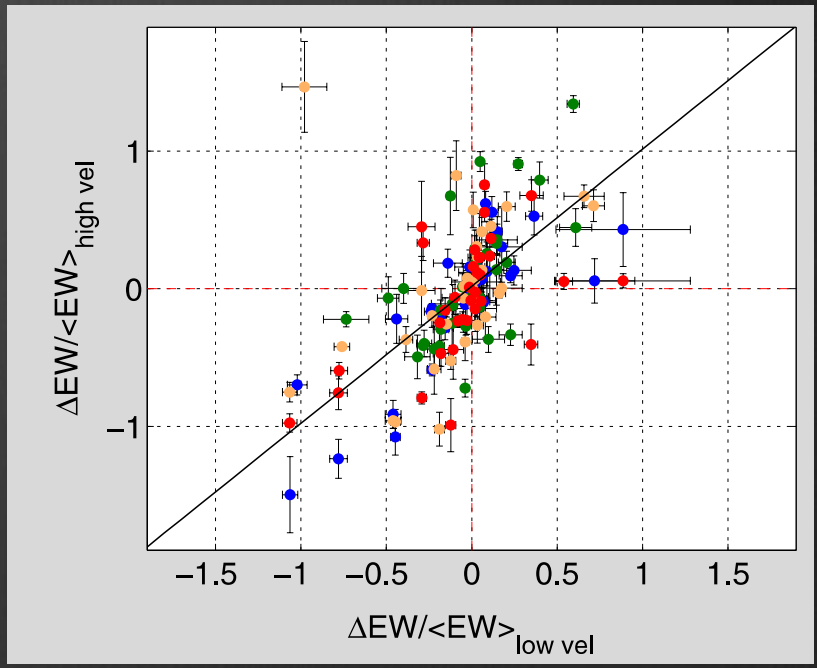
1-Rüzgar maddesinin hareketi
2- Rüzgar maddesinin iyonizasyon seviyesinin değişmesi
3- Rüzgarın kendi içindeki kararsızlıklar



Çoklu BAL yapısına sahip 107 kuazarın ~ %78'inde koordine değişimler gözlendi.

➔ Olasılık 10^{-12}

İki BAL yapısı arasındaki hız farkının 15000–20000 km s^{-1} olduğu durumlarda dahi koordine değişimler görülüyor.



Yığılma diskinden karadelik üzerine madde düştüğünü gösteren **ilk gözlemsel** bulgu!!!

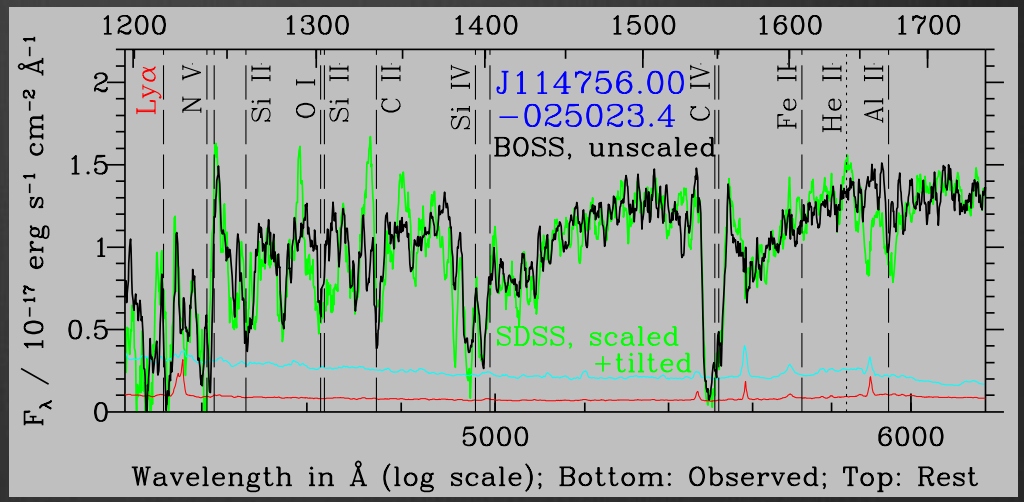
Mon. Not. R. Astron. Soc. **000**, 1–40 (2012) Printed 13 June 2013 (MN LATEX style file v2.2)

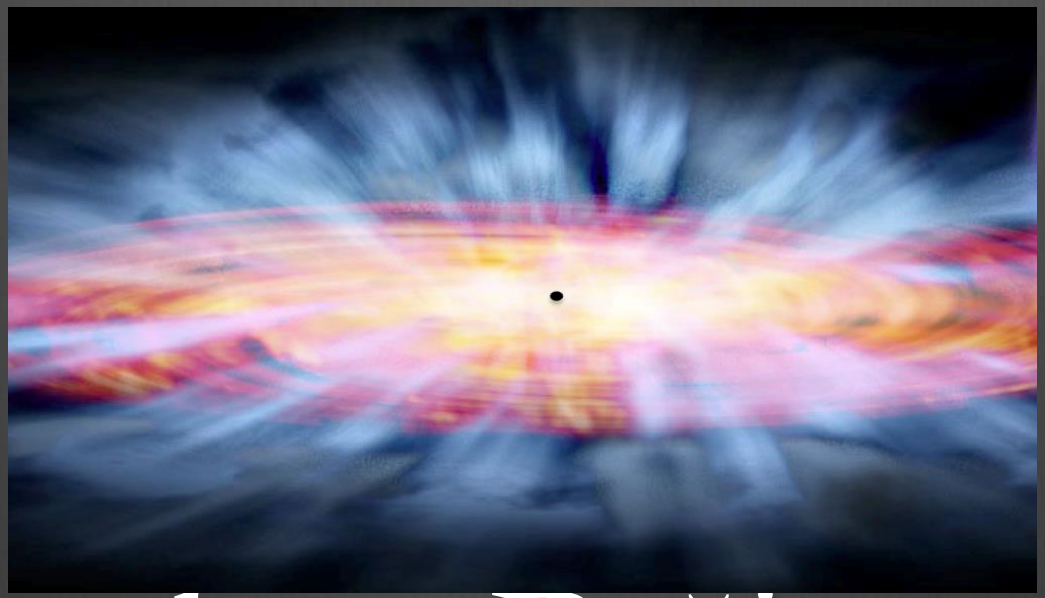
Basın Duyurusu yapıldı

Broad Absorption Line Quasars with Redshifted Troughs: High-Velocity Infall or Rotationally Dominated Outflows?

P. B. Hall[1⋆], W. N. Brandt[2,3], P. Petitjean[4], I. Pâris[4], N. Filiz Ak[2,3,5], Yue Shen,[6,16]
R. R. Gibson[7], É. Aubourg[8], S. F. Anderson[7], D. P. Schneider[2,3], D. Bizyaev[9],
J. Brinkmann,[9], E. Malanushenko[9], V. Malanushenko[9], A. D. Myers[10],
D. J. Oravetz[9], N. P. Ross[11], A. Shelden[9], A. E. Simmons[9],
A. Streblyanska[12], B. A. Weaver[13], D. G. York[14,15]

- Karadelik çevresindeki diskten ruzgarla madde atilmasi ve karadelik buyumesinin ikincil gozlemsel bulgusu!





Kuazarların Değişen Rüzgar Yapıları

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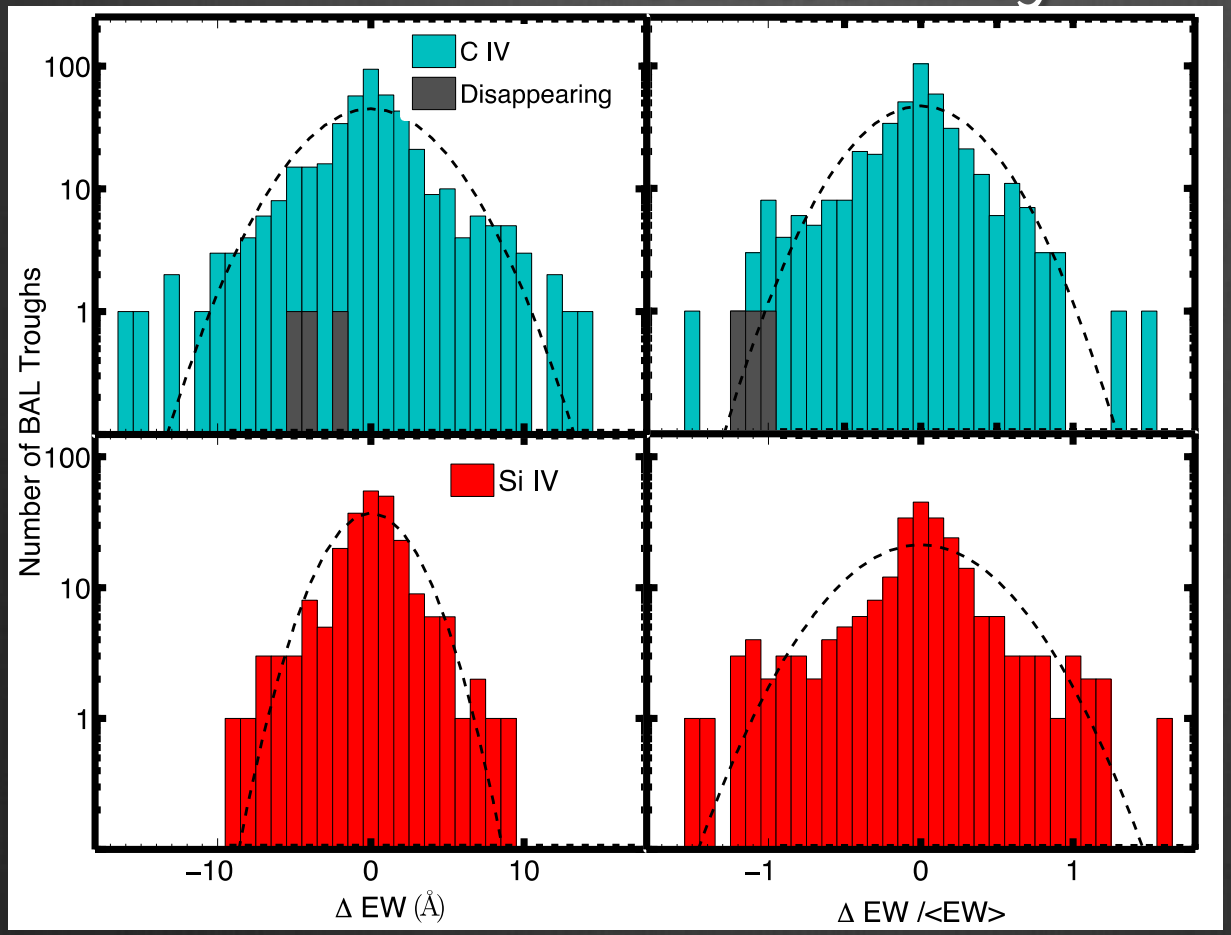
Extra Slides

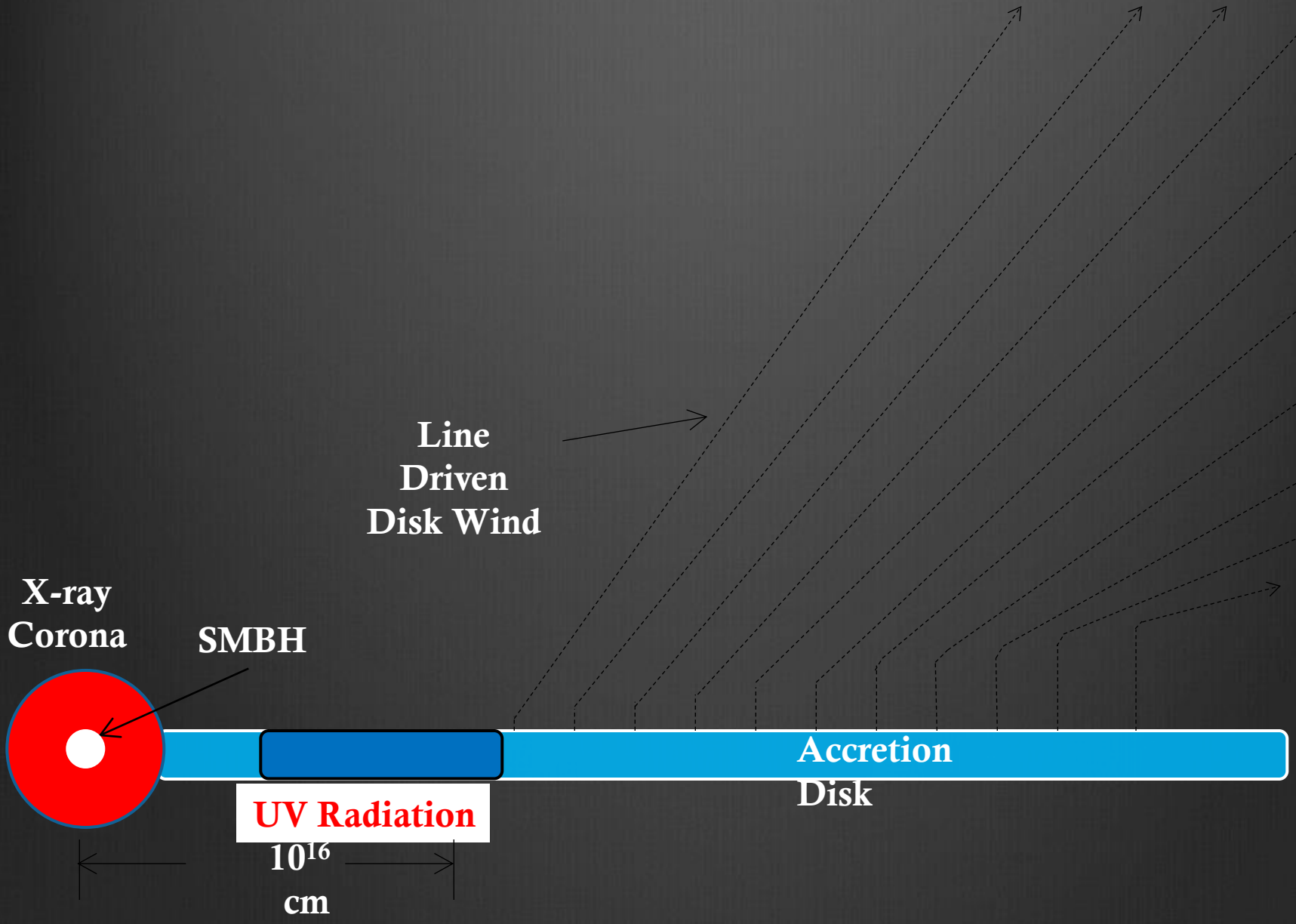
Characteristics of BAL EW Variability

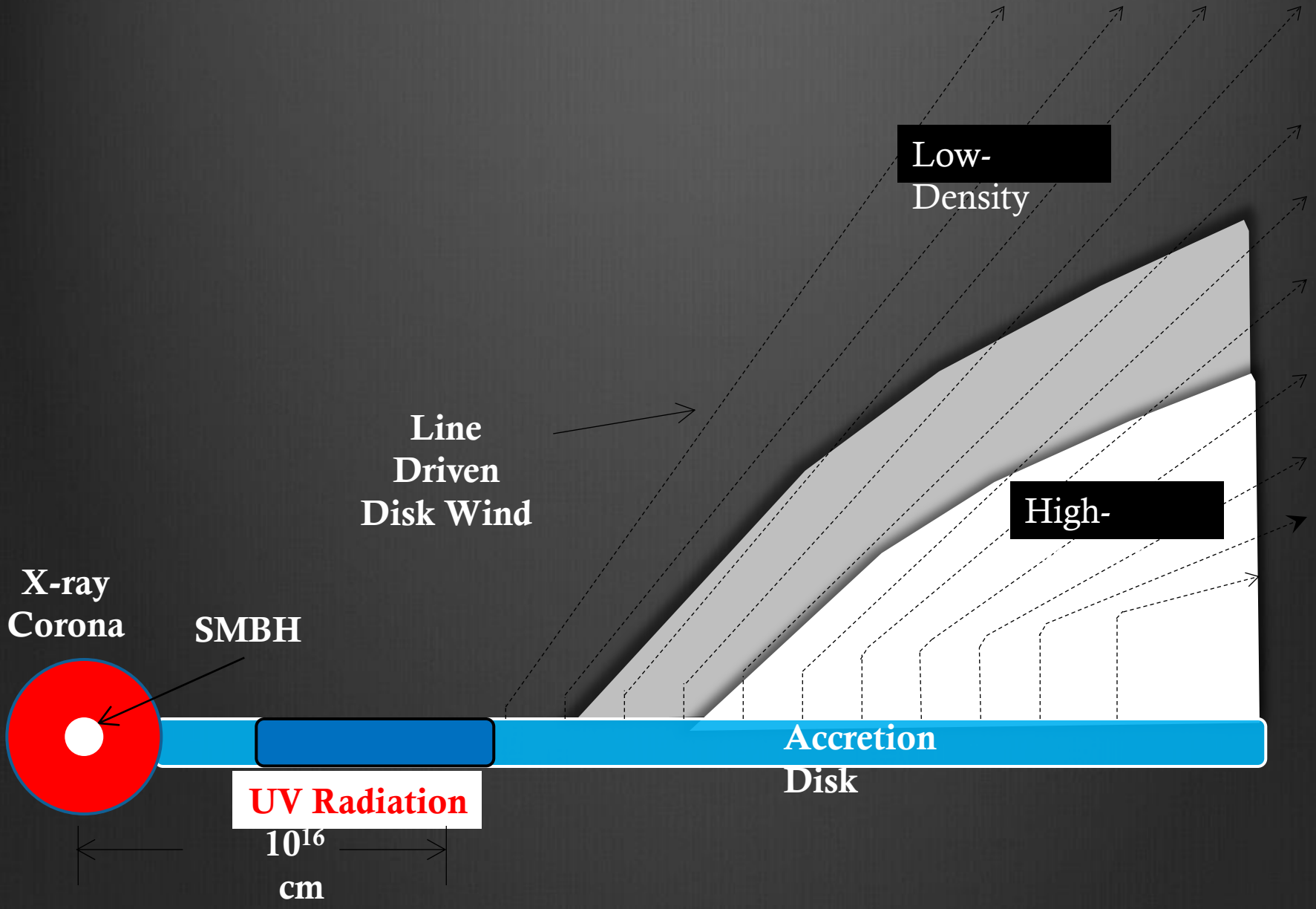


Symmetric;
BALs do not strengthen and weaken at different rates

Not Bimodal;
Disappearance and emergence are extremes of variations; not distinct distributions

Non-Gaussian;
ΔEW and fractional ΔEW distributions are not normal distributions


Line
Driven
Disk Wind
X-ray
Corona
SMBH
Accretion
Disk
UV Radiation
10^{16}
cm


Low-
Density
Line
Driven
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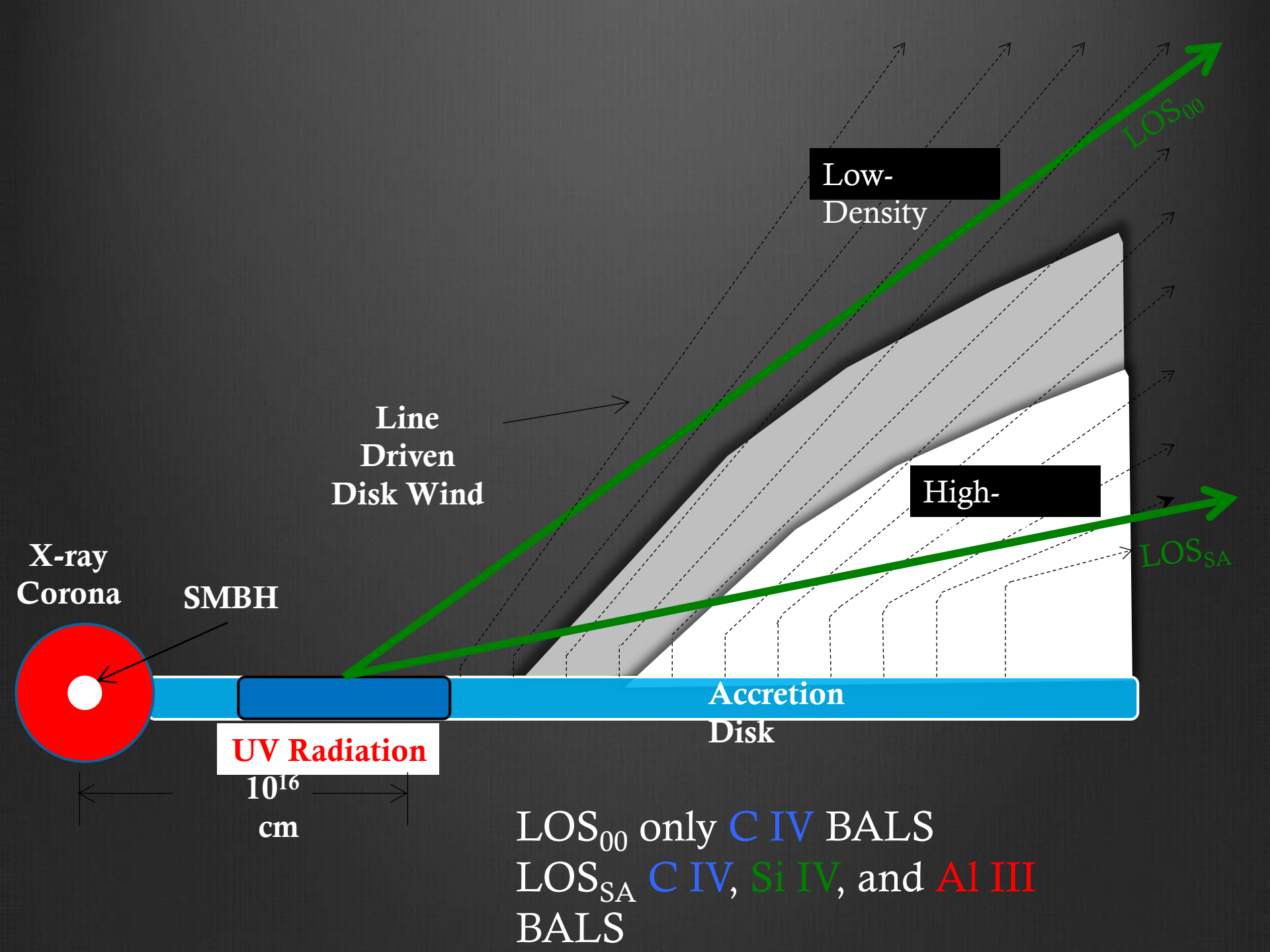
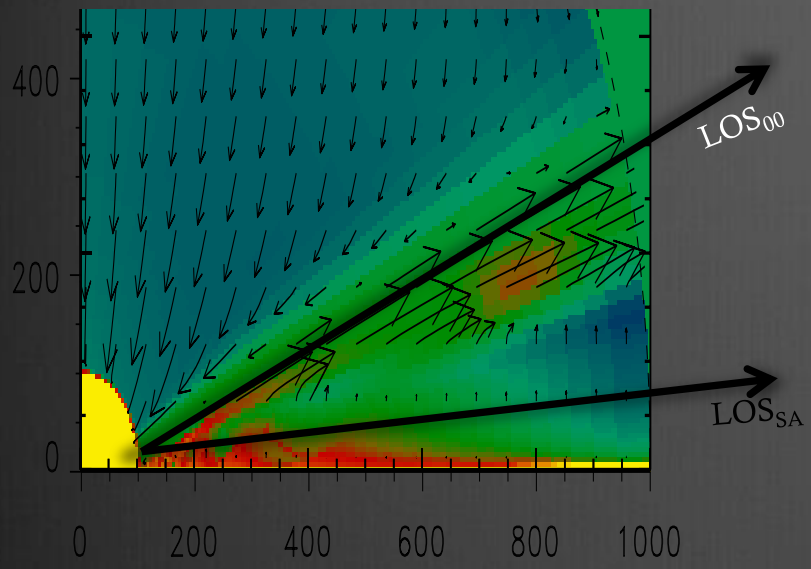


LOS_{00} only C IV BALS

LOS_{SA} C IV, Si IV, and Al III BALS



CIV

LOS00

Low-Density

High-

LOSSA

CIV
SiIV
AlIII

X-ray Corona

SMBH

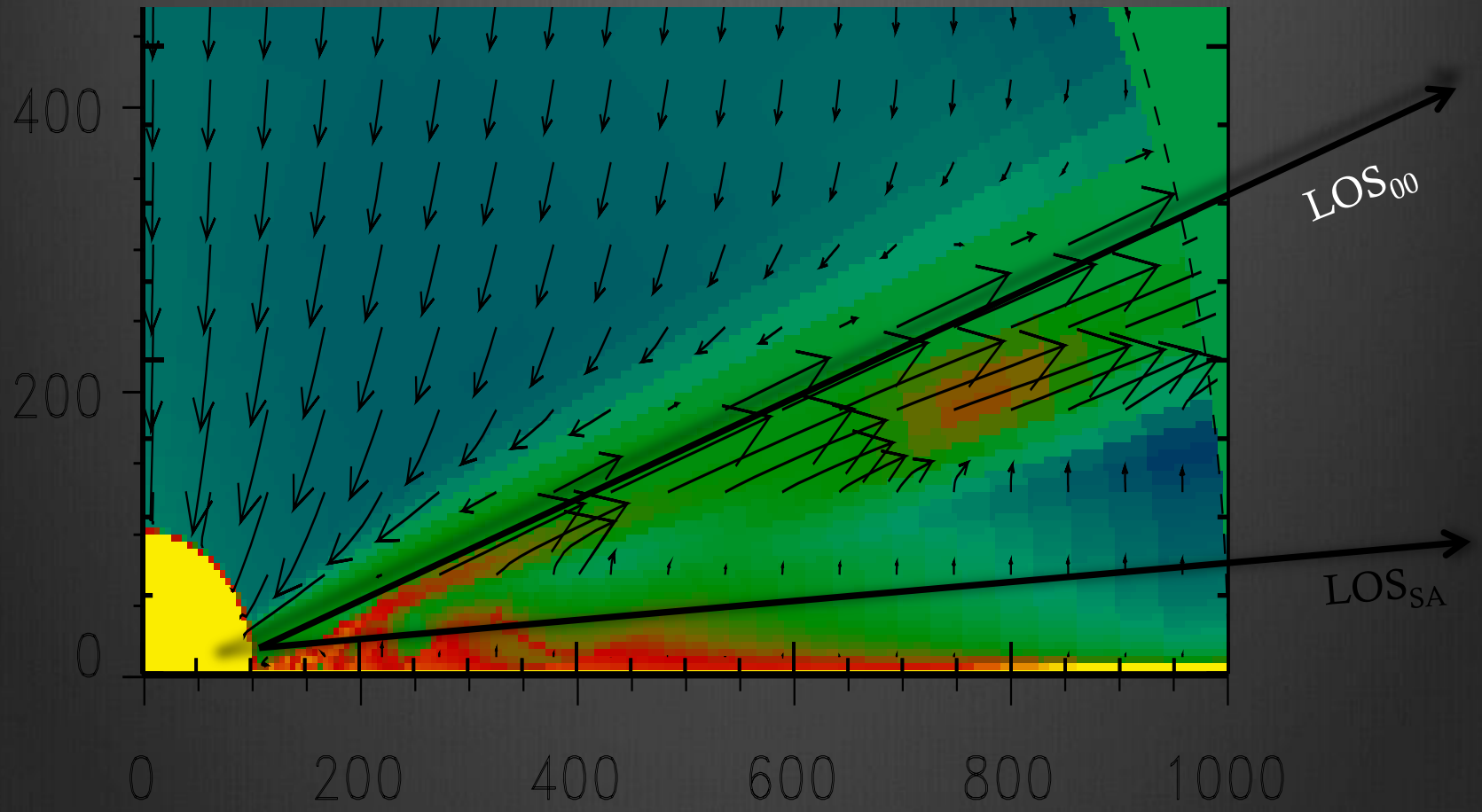
Accretion Disk

Column density is larger along LOS_{SA}

Broader range of velocity along LOS_{SA}

- CIV_SA to be deeper
- CIV_SA to be less variable
- CIV_SA to be wider
- AlIII to lie in low-velocity portions

Optical depth is velocity dependent



Column density is larger along LOS_{SA}

Broader range of velocity along LOS_{SA}

- CIV_SA to be deeper
- CIV_SA to be less variable

- CIV_SA to be wider
- AlIII to lie in low-velocity portions