Eta Carinae: X-ray Emission and New Developments

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ROSAT detection of X-ray variability

Chandra X-ray Image
Chandra X-ray imaging

Seward et al. 2001, Weis et al. 2001 (Chandra Workshop Proceedings)
The RXTE Lightcurve

Last datum: July 6, 2002
Currently: 1 observation every 4-5 days
PCU2: most complete lightcurve
“Flares”: complex shapes
Lightcurve Modelling

Attempt to fit RXTE 2-10 keV lightcurve with hydro colliding wind model + skewed shock cone
Other attempts: Pittard et al. 1998; Ishibashi et al. 1999; Corcoran et al. 2001; Ishibashi 2001 (Hven meeting)
March 12, 2002 - unexpected brightening in 2-10 keV flux
  • abnormally strong “flare”?
  • starting “activity” stage sooner than in past cycle? (will it start “eclipse” sooner too?)
“Flare” has apparently ended but flux is still brighter than previous level!
The Chandra High Energy Grating Spectrum

- Strong Lines (inc. Fe K thermal + fluorescence)
- Multi-T and high T (near $10^8$ K) => measuring shocked wind of companion?
WR 140 X-ray Variability

WR 140 is a long period (P=2900\textsuperscript{d}) eccentric (e=0.8) WC7+O4-5 binary. It shows periodic dust formation (near periastron), strong radio variations, and strong X-ray variations.

RXTE observations near periastron (phase 2.0) show a rapid decline along with an X-ray “eclipse” similar to that in Eta Car
Direct comparison of WR 140 & Eta Car

Similarities: eclipse depth, rate of decline, asymmetry

Dissimilarities: width of eclipse, rate of decline after eclipse
WR 140: broad, blueshifted lines, low f/i ratio
Eta Car: Narrow, unshifted, large f/i ratio
Expected Behavior during the Next Event

- **PCU2 L1 Net rate**

- **Net PCU2 counts s⁻¹**

- **Time (years):**
  - 1997.6
  - 1997.8
  - 1998.0
  - 1998.2
  - 1998.4

- **Dates:**
  - 1997-09-28
  - 1997-10-27
  - 1997-11-09
  - 1997-12-07
  - 1997-12-11
  - 1998-01-23
  - 1998-03-06

- **Net PCU2 counts s⁻¹**

- **Time (years):**
  - 2003.0
  - 2003.2
  - 2003.4
  - 2003.6
  - 2003.8
  - 2004.0

- **Dates:**
  - 2003-05-22
  - 2003-06-19
  - 2003-06-23
  - 2003-06-27
  - 2003-08-05
  - 2003-09-16
The Fate of Eta Carinae?

“They finally came together in a fearful last death grip, in the midst of thick clouds and tempestuous elements; they fell to the ground with such force that they shook the whole world.”

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Spectral Variations - Eta Car

Perhaps not seeing star at all?

Using absorbed 2-T Mekal model based on Chandra Spectrum
Spectral Variations - WR 140

Using 1-T Bremmstrahlung model
Gradual shortening of flare interval on approach to periastron?

“In a broad class of models, the 85-day recurrence interval is predicted to lengthen drastically in 1998 after the two stars pass periastron”, (Davidson, Ishibashi & Corcoran, 1998, NewA, 3, 241)