Binarias de rayos X

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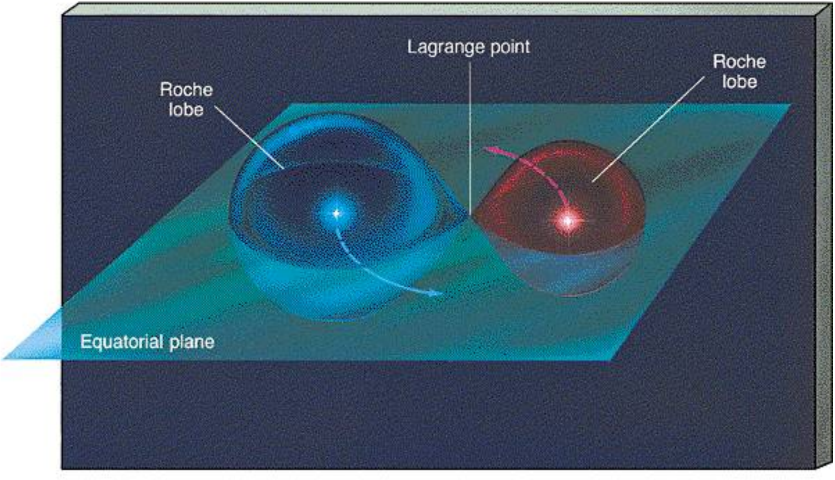
La potencia del acrecimiento

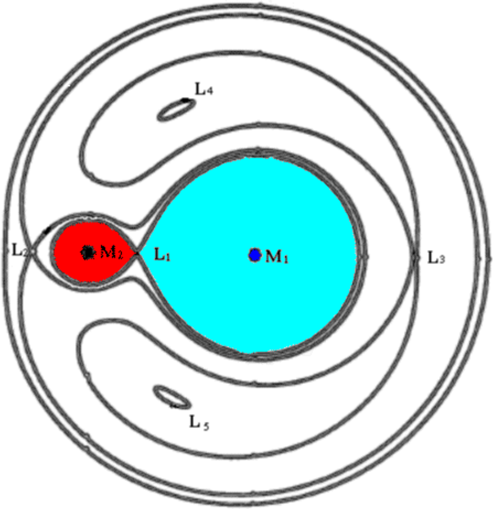
- Energía generada:
  $\Delta E_{ac} = \frac{GMm}{R}$
  - En el caso de una estrella de neutrones:
  - $R \sim 10Km$
  - $M \sim M_{\odot}$
  - $\Delta E_{ac} = 10^{20}\ erg\ g^{-1}$

- Energía de fusión nuclear:
  $\Delta E_{fusion} \sim 0.007mc^2 \sim 6 \times 10^{18} erg\ g^{-1}$

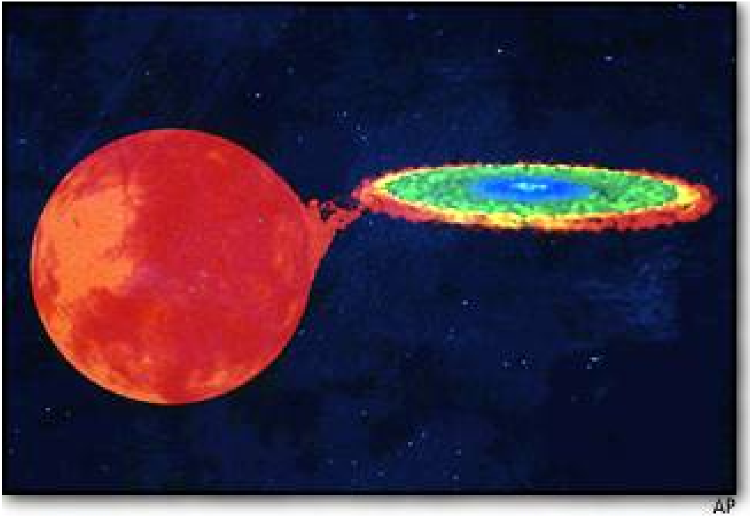
Lóbulos de Roche



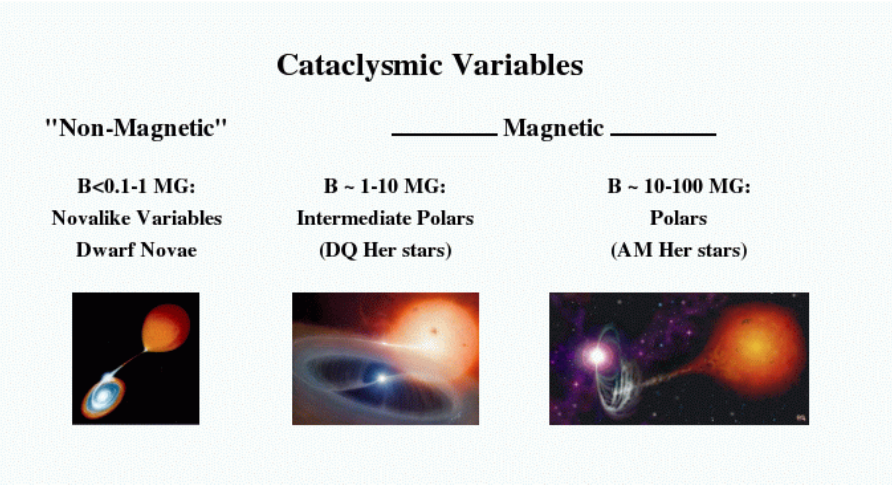
Lóbulos de Roche



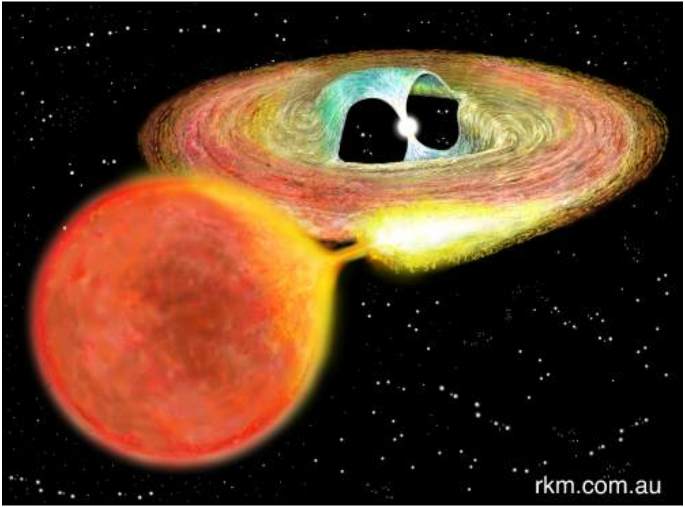
Desbordamiento del lóbulo de Roche



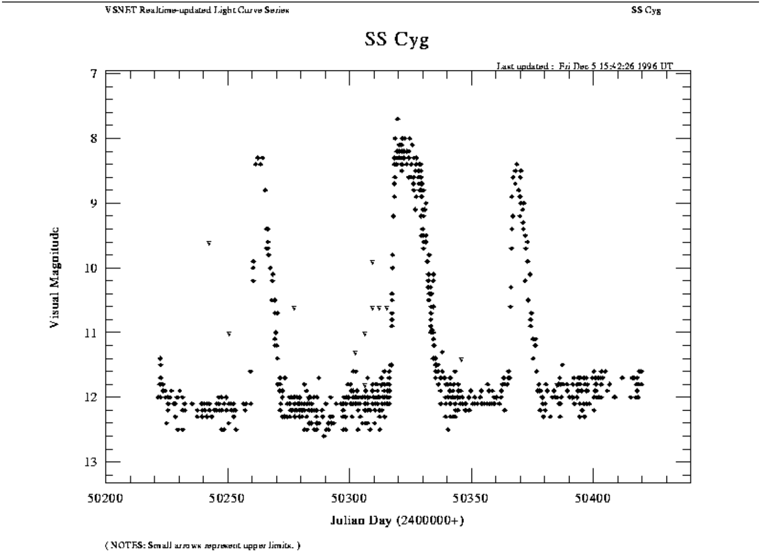
Variables cataclísmicas



Polar intermedia

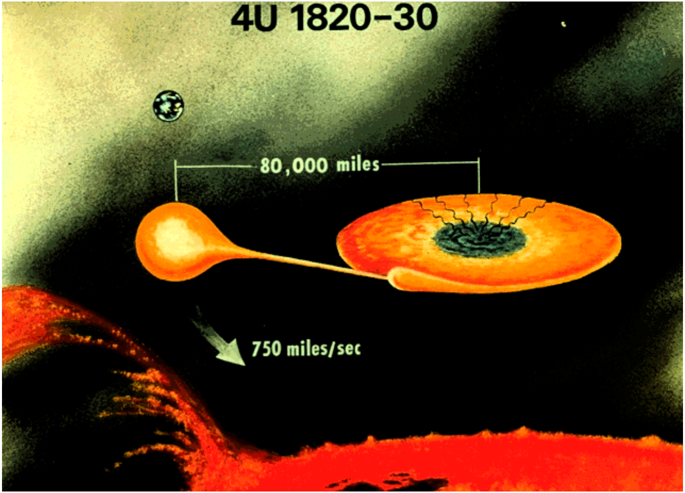


SS Cygni



VSNET Realtime-updated Light Curve Series
SS Cyg
SS Cyg
Last updated : Fri Dec 5 15:42:26 1996 UT
Visual Magnitude
7
8
9
10
11
12
13
50200
50250
50300
50350
50400
Julian Day (2400000+)
(NOTES: Small arrows represent upper limits.)

Binarias de rayos X de baja masa



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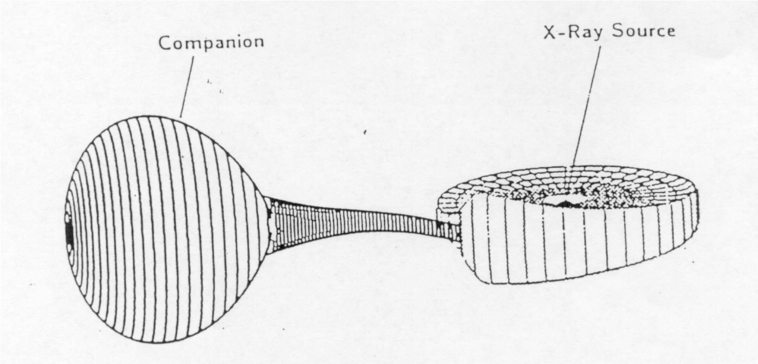
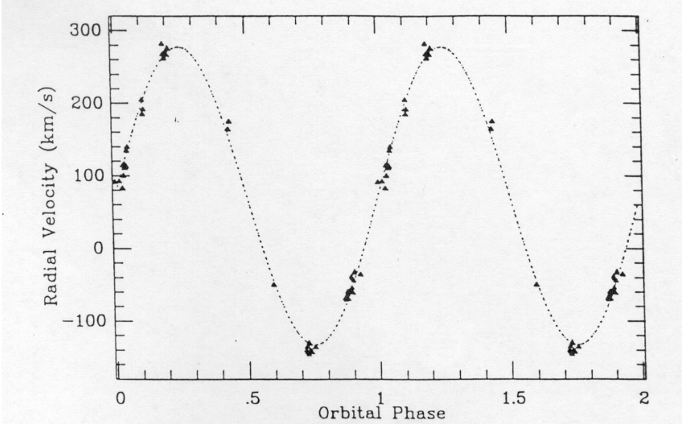


La función de masa

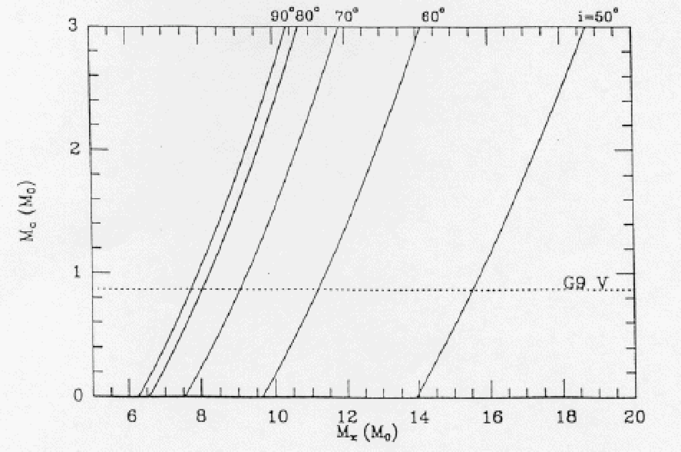
- $K_1 = v_1 \sin i = \frac{2\pi a_1 \sin i}{P}$
- $K_2 = v_2 \sin i = \frac{2\pi a_2 \sin i}{P}$

- $\frac{m_2^3 \sin^3 i}{(m_1+m_2)^2} = \frac{K_1^3 P}{2\pi G} = f(m_2)$
- $\frac{m_2^3 \sin^3 i}{(m_1+m_2)^2} = \frac{K_2^3 P}{2\pi G} = f(m_1)$

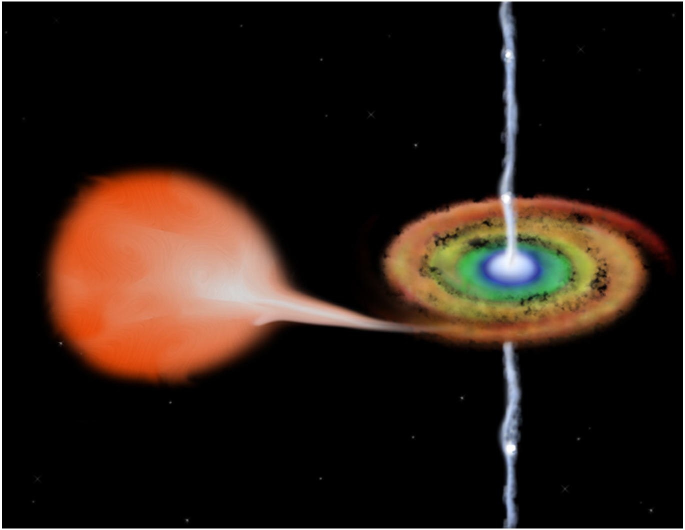
V404 Cygni



V404 Cygni



Agujero negro en binaria



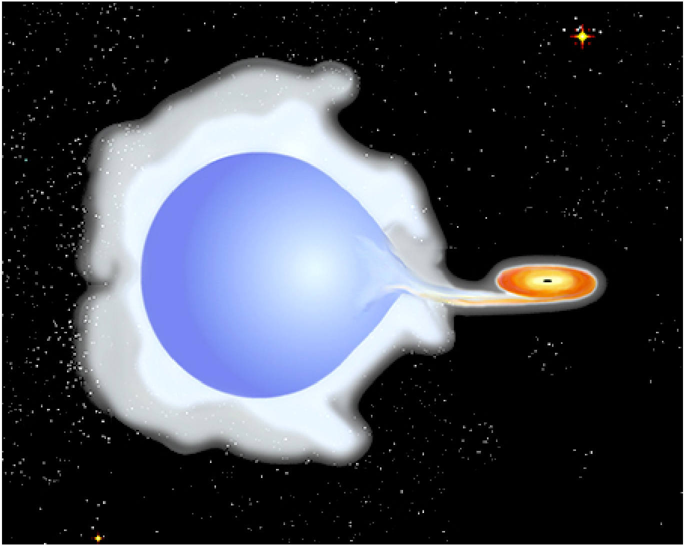
Agujeros negros en binarias

Black Hole Candidates in Binary Star Systems

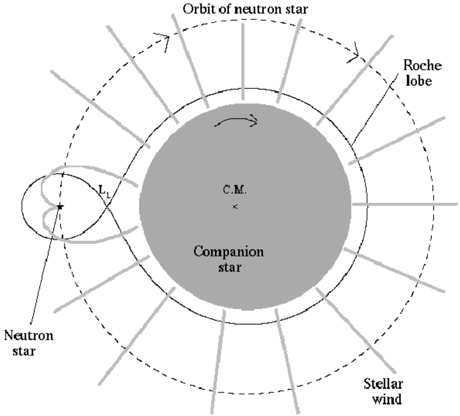
Name of Binary System	Companion Star Spectral Type	Orbital Period (days)	Black Hole Mass (Solar Units)
Cygnus X-1	B supergiant	5.6	6-15
LMC X-3	B main sequence	1.7	4-11
A0620-00 (V616 Mon)	K main sequence	7.8	4-9
GS2023+338 (V404 Cyg)	K main sequence	6.5	>6
GS2000+25 (QZ Vul)	K main sequence	0.35	5-14
GS1124-683 (Nova Mus 1991)	K main sequence	0.43	4-6
GRO J1655-40 (Nova Sco 1994)	F main sequence	2.4	4-5
H1705-250 (Nova Oph 1977)	K main sequence	0.52	>4

SOURCE: Fraknoi, Morrison, & Wolff, *Voyages through the Universe*

Binarias de rayos X de gran masa (HMXRB)



Binarias de rayos X supergigantes (SGXRBs)



Binarias de rayos X Be (Be/XRBs)

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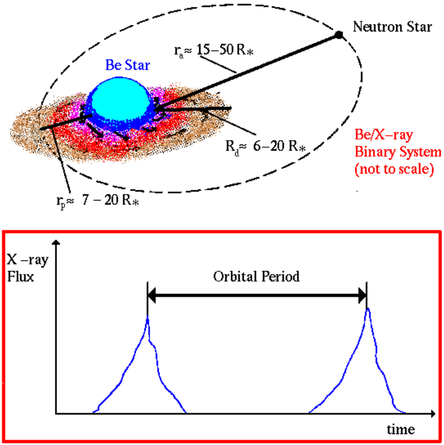
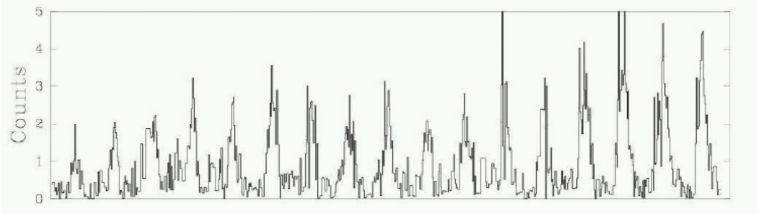
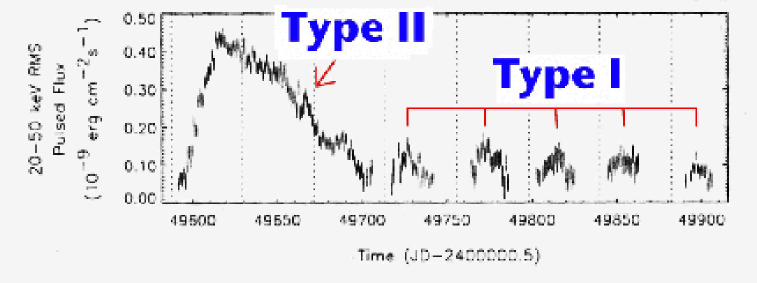
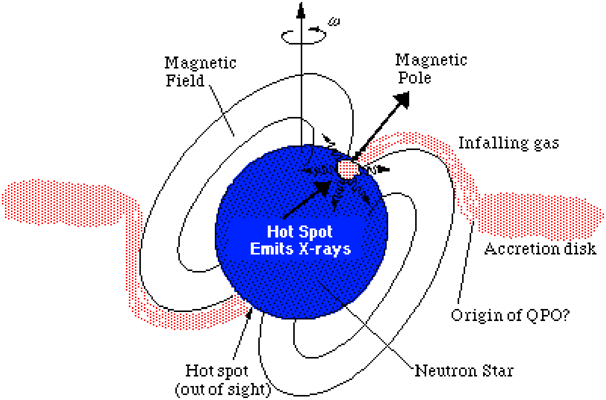


EXO 2030+375

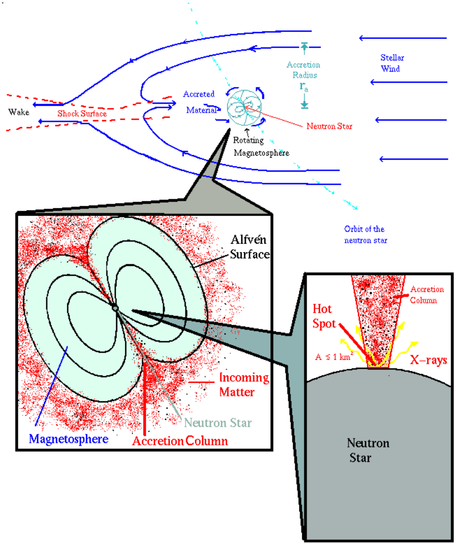



Type II
Type I
20–50 keV RMS Pulsed Flux (10^{-9} erg cm^{-2}s^{-1})
0.50
0.40
0.30
0.20
0.10
0.00
49500
49550
49700
49750
49800
49850
49900
Time (JD−2400000.5)

Pulsar de rayos X



Pulsar de rayos X



Régimen de acrecimiento

- Radio de la magnetosfera:
  $\frac{B(r_m)^2}{8\pi} = \rho(r_m)v(r_m)^2$

- Radio de corrotación:
  $r_c = \left(\frac{GMP_s^2}{4\pi^2}\right)^{\frac{1}{3}}$

  - Si $r_c > r_m \rightarrow$ acrecimiento
  - Si $r_c < r_m \rightarrow$ eyección

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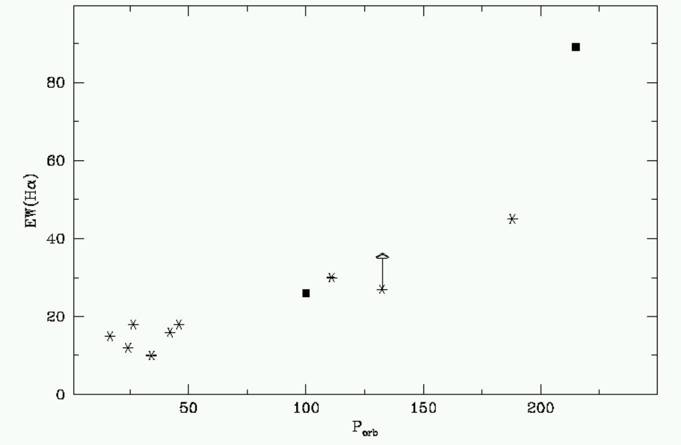
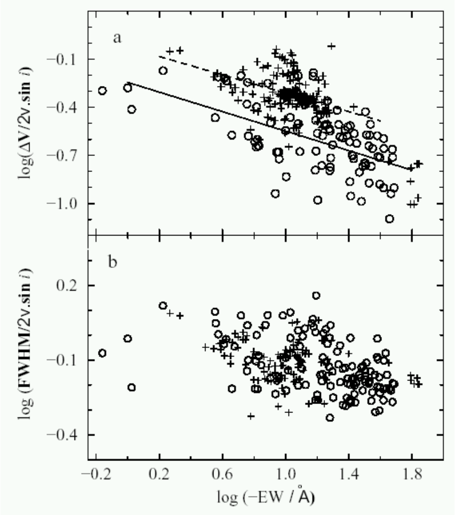
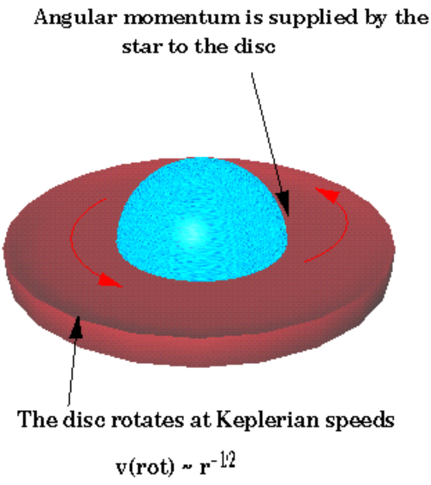


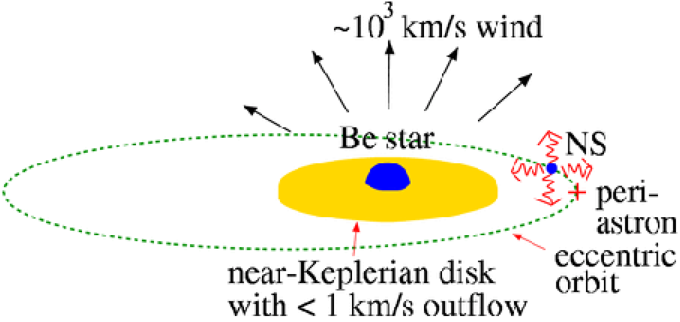
Binarias de rayos X Be (Be/XRBs)



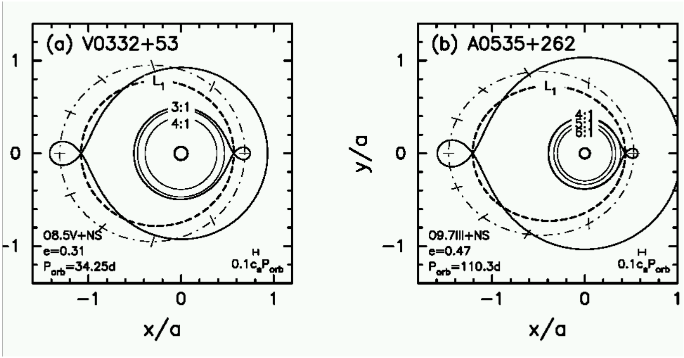
Disco de decrecimiento viscoso



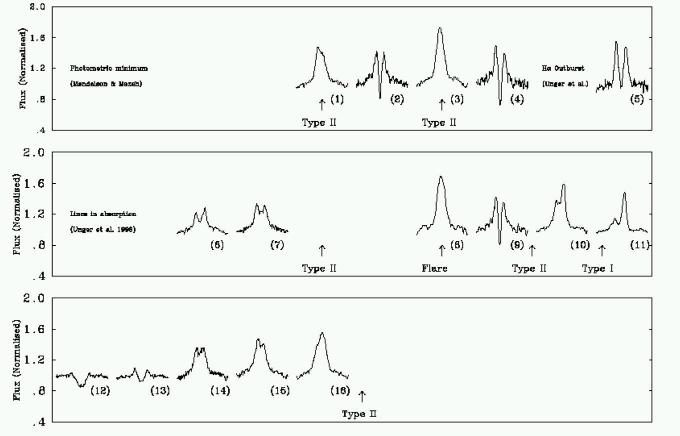
Truncación del disco



Truncación del disco

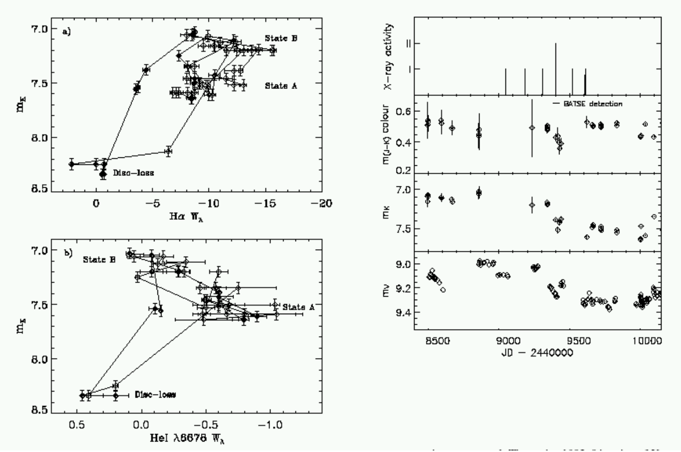


4U 0115+63



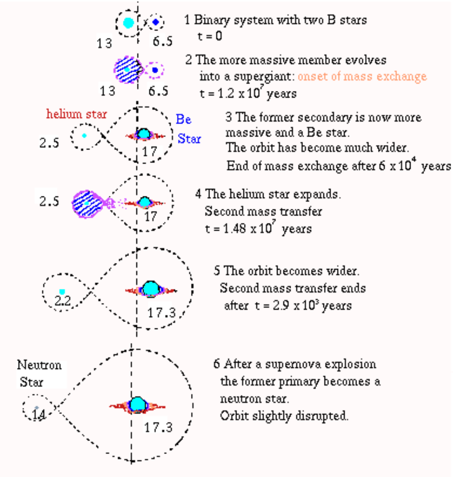
2.0
1.6
1.2
.8
.4
Flux (Normalised)
Photometric minimum
(Mendelson & Mazeh)
(1)
(2)
(3)
(4)
(5)
Type II
Type II
Hα Outburst
(Unger et al.)
Lines in absorption
(Unger et al. 1998)
(6)
(7)
(8)
(9)
(10)
(11)
Type II
Flare
Type II
Type I
(12)
(13)
(14)
(15)
(16)
Type II

A 0525+36

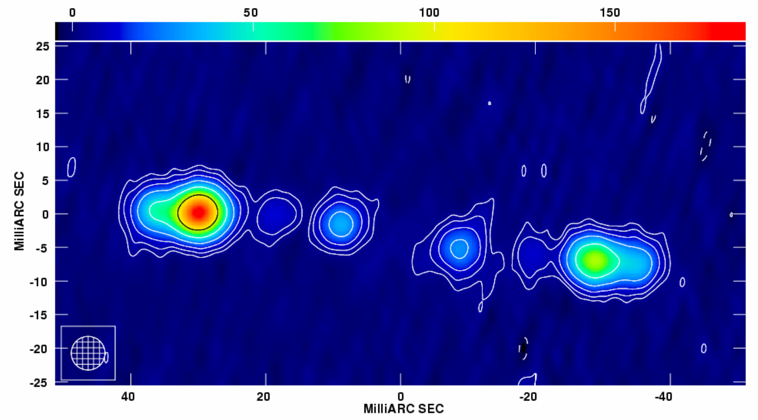


a)
State B
State A
Disc–loss
m_K
Hα W_λ
b)
State B
State A
Disc–loss
m_K
HeI λ6678 W_λ
X–ray activity
BATSE detection
m(J–K) colour
m_K
m_V
JD – 2440000

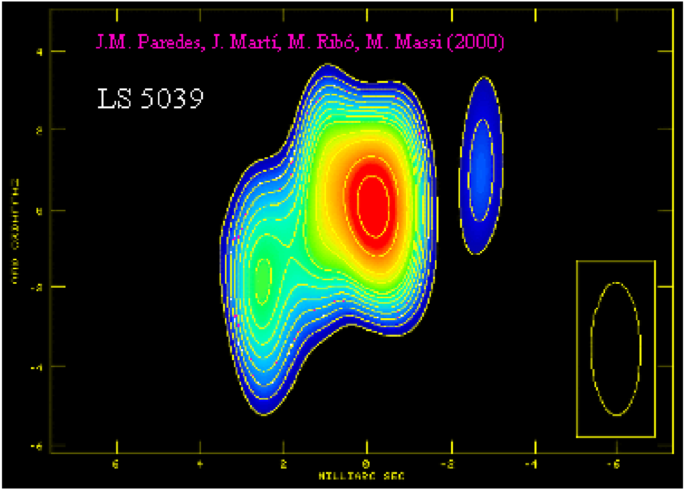
Formación de las binarias de rayos X de gran masa



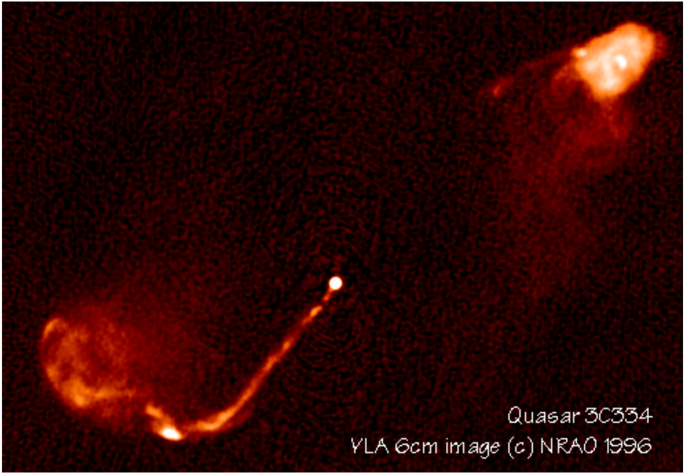
Microcuásares (SS 433)



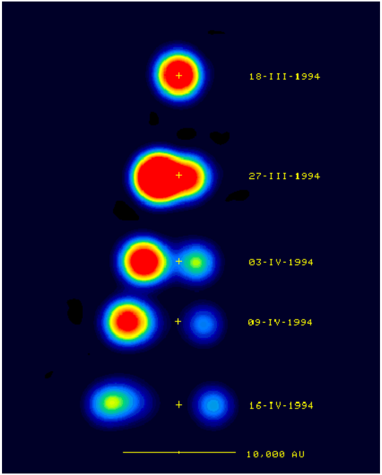
Microcuásares

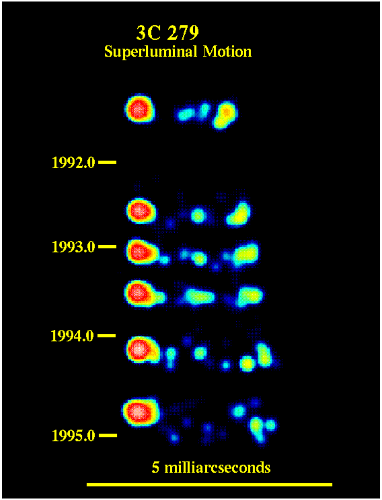


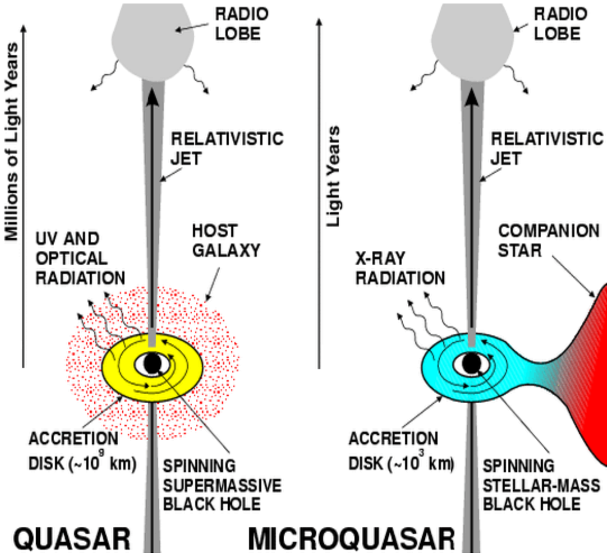
Microcuásares



Microcuásares






RADIO LOBE
RELATIVISTIC JET
Millions of Light Years
UV AND OPTICAL RADIATION
HOST GALAXY
ACCRETION DISK (~10^9 km)
SPINNING SUPERMASSIVE BLACK HOLE
QUASAR
RADIO LOBE
RELATIVISTIC JET
Light Years
COMPANION STAR
X-RAY RADIATION
ACCRETION DISK (~10^3 km)
SPINNING STELLAR-MASS BLACK HOLE
MICROQUASAR

Microcuásares