A lesson I take from **ILOTs:** Follow the jets

ILOTs: Intermediate Luminosity Optical Transients

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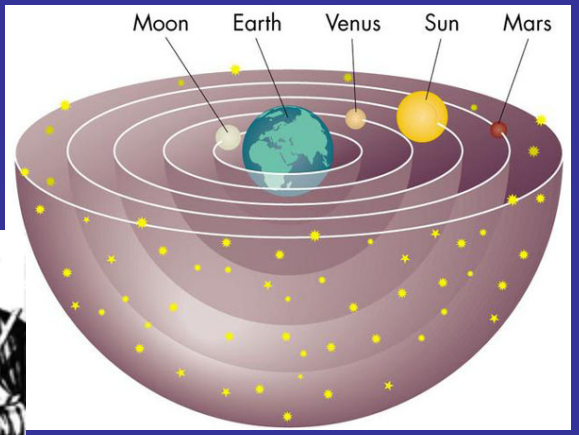
On the name:

Romek Tylenda prefers the name *Red Nova*. However, the referee forced him to use *Red Transient* (recent paper on OGLE-2002-BLG-360; Tylenda et al. 2013).

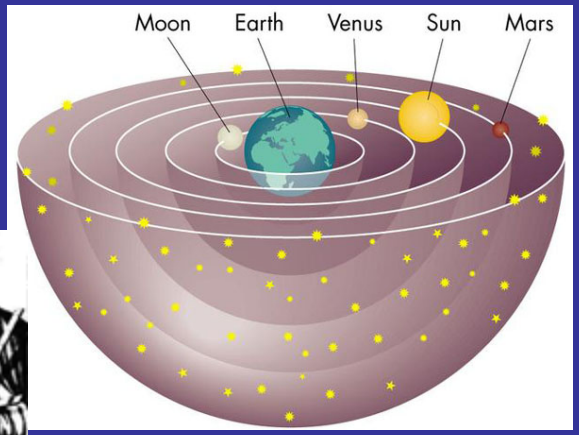
In my group and in the planetary community the name is *ILOT*.

Geocentric
(Earth in the center)



Heliocentric
(Sun in the center)

Geocentric (Earth in the center)



Heliocentric (Sun in the center)

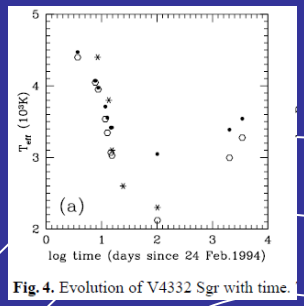
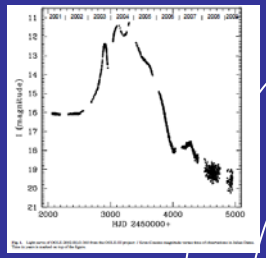
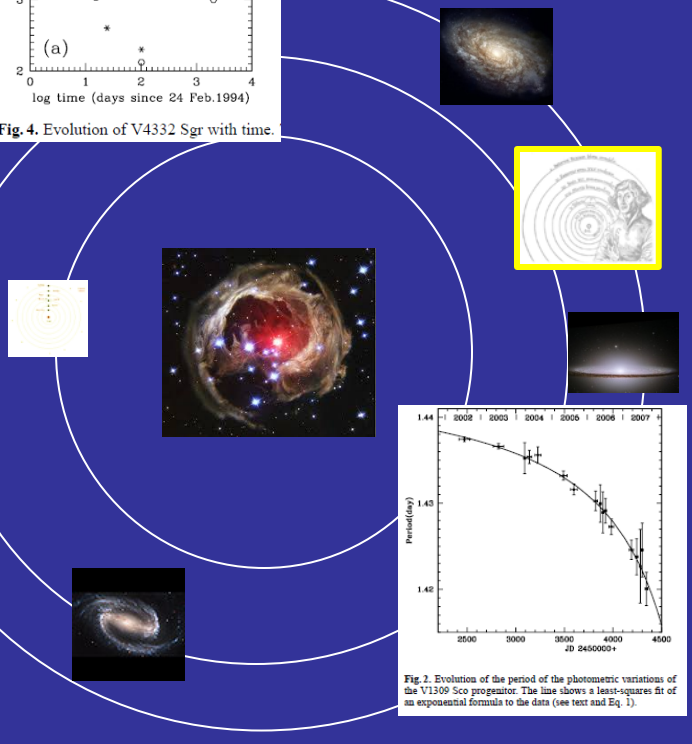


Fig. 4. Evolution of V4332 Sgr with time.





Monocentric (V838 Monocerotis in the center)

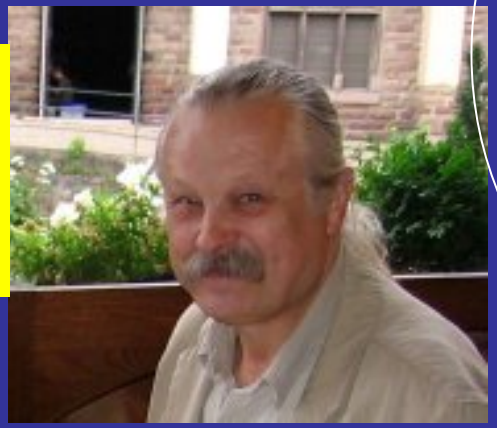
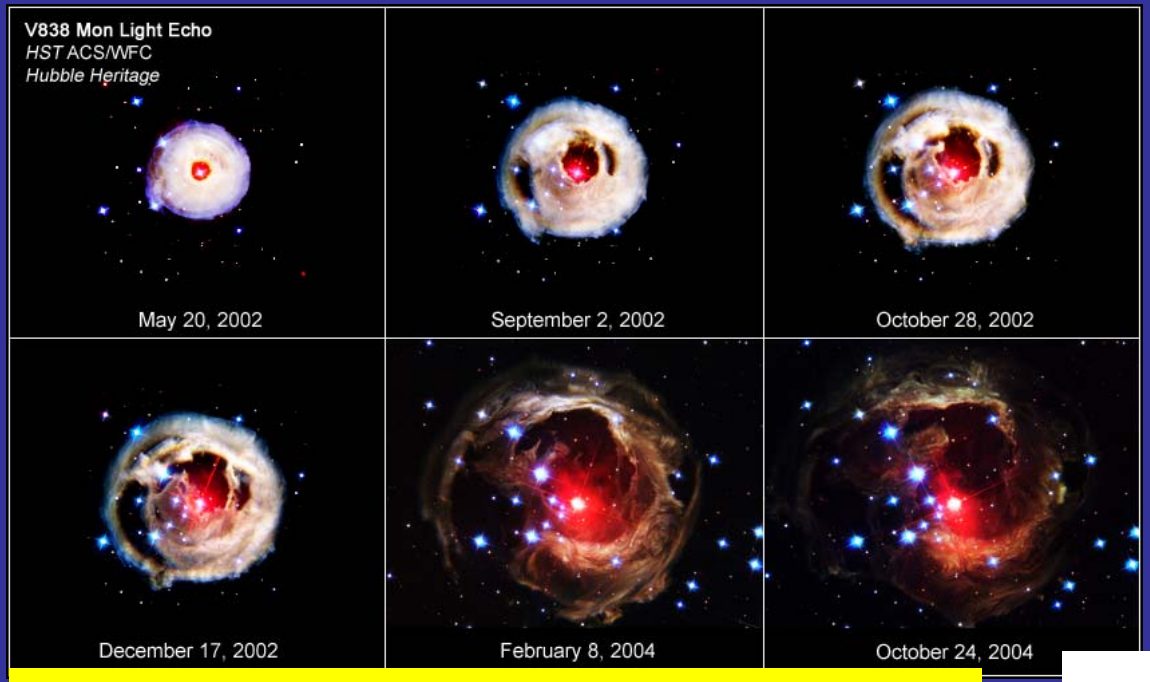


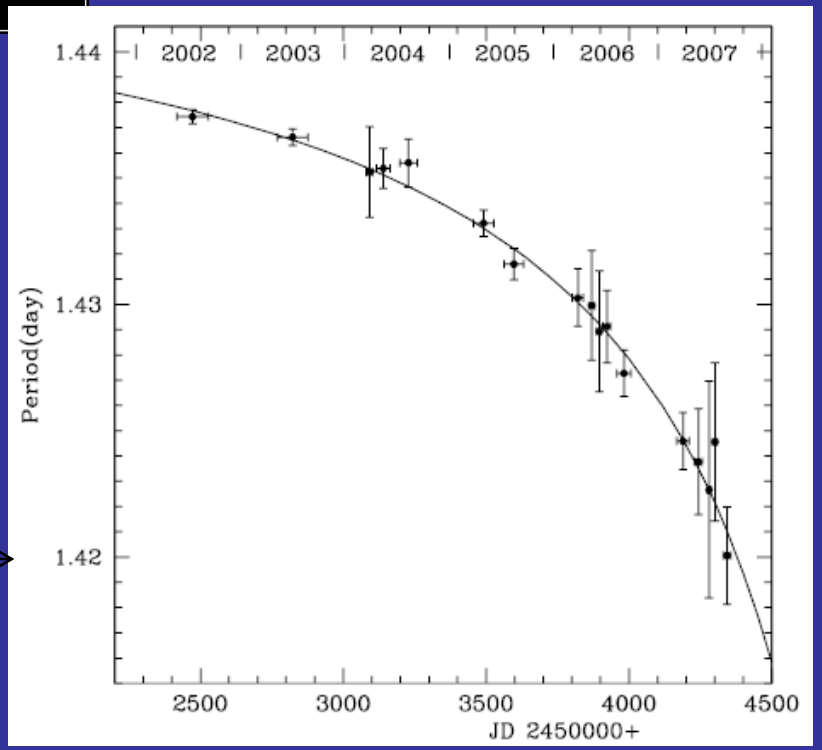
Fig. 2. Evolution of the period of the photometric variations of the V1309 Sco progenitor. The line shows a least-squares fit of an exponential formula to the data (see text and Eq. 1).



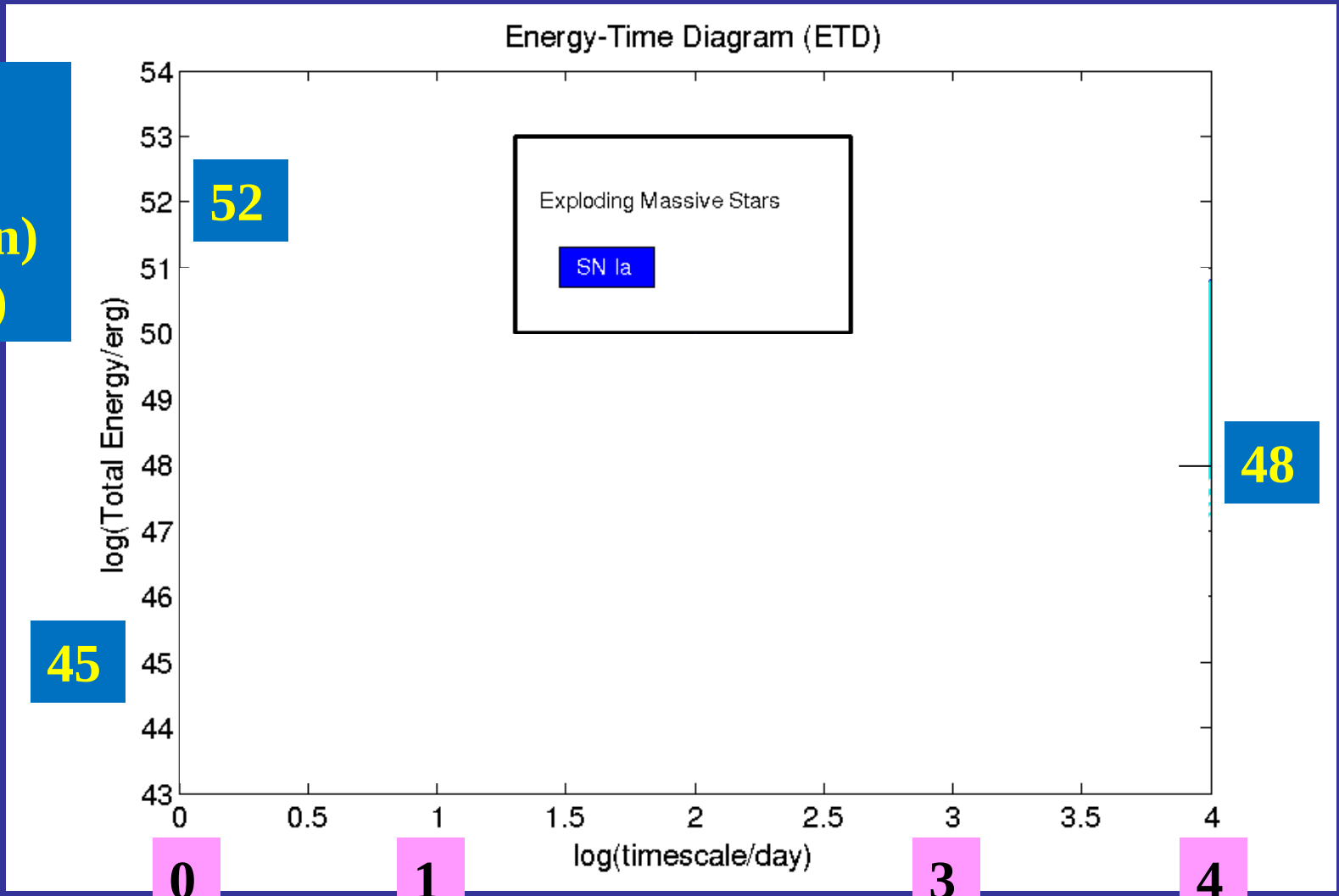
The stellar merger model for

V838 Mon

(Tylenda & Soker in 8 papers) is the most common model now. It was put on a very solid ground with the work of Tylenda et al. (2011) on V1309 Scorpii.



Total (Kinetic +radiation) log(E/erg)



52

48

45

0

1

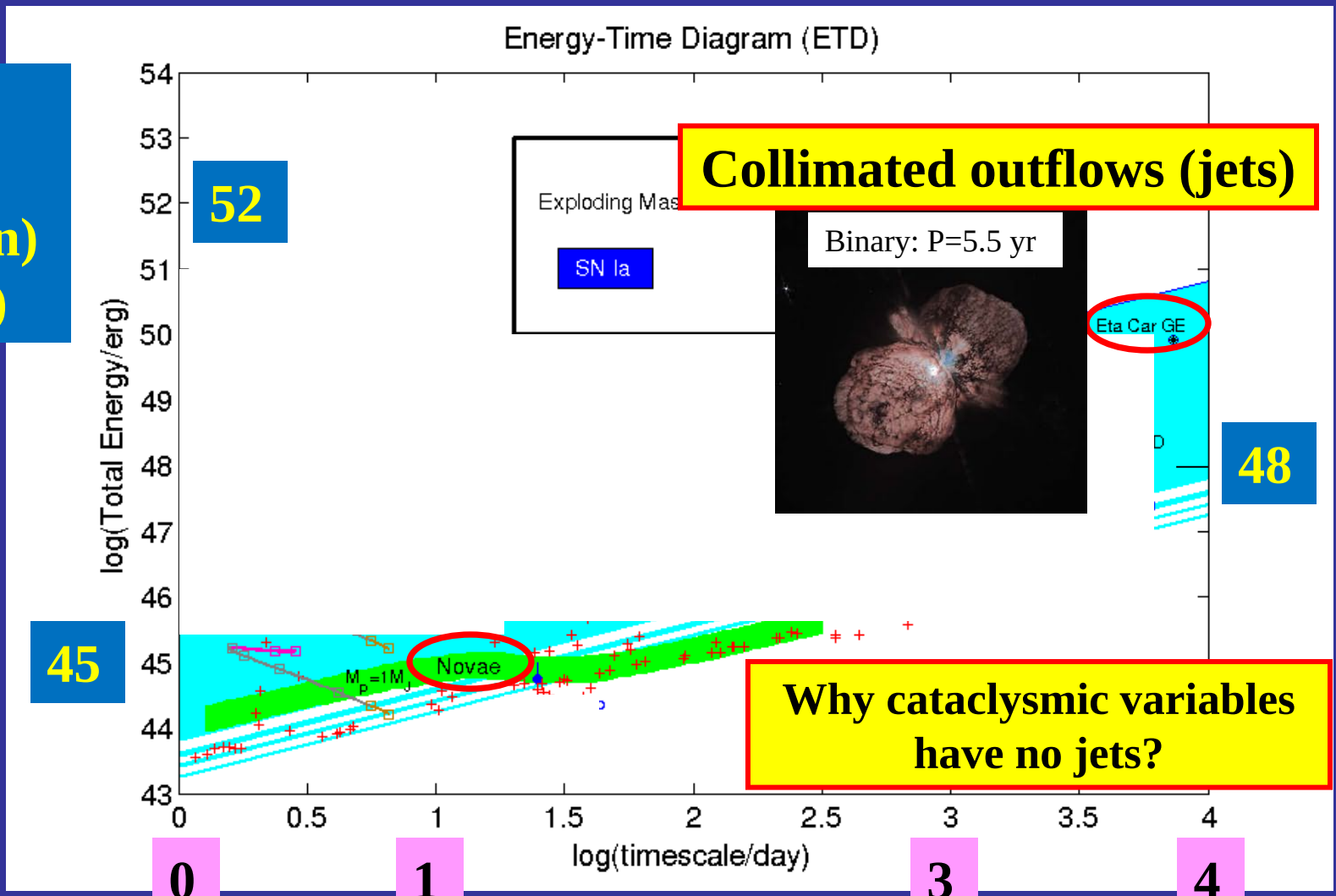
3

4

Log(time/day)

From *Amit Kashi*
Updated in:
http://physics.technion.ac.il/~ILOT/

Total (Kinetic +radiation) log(E/erg)



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Collimated outflows (jets)

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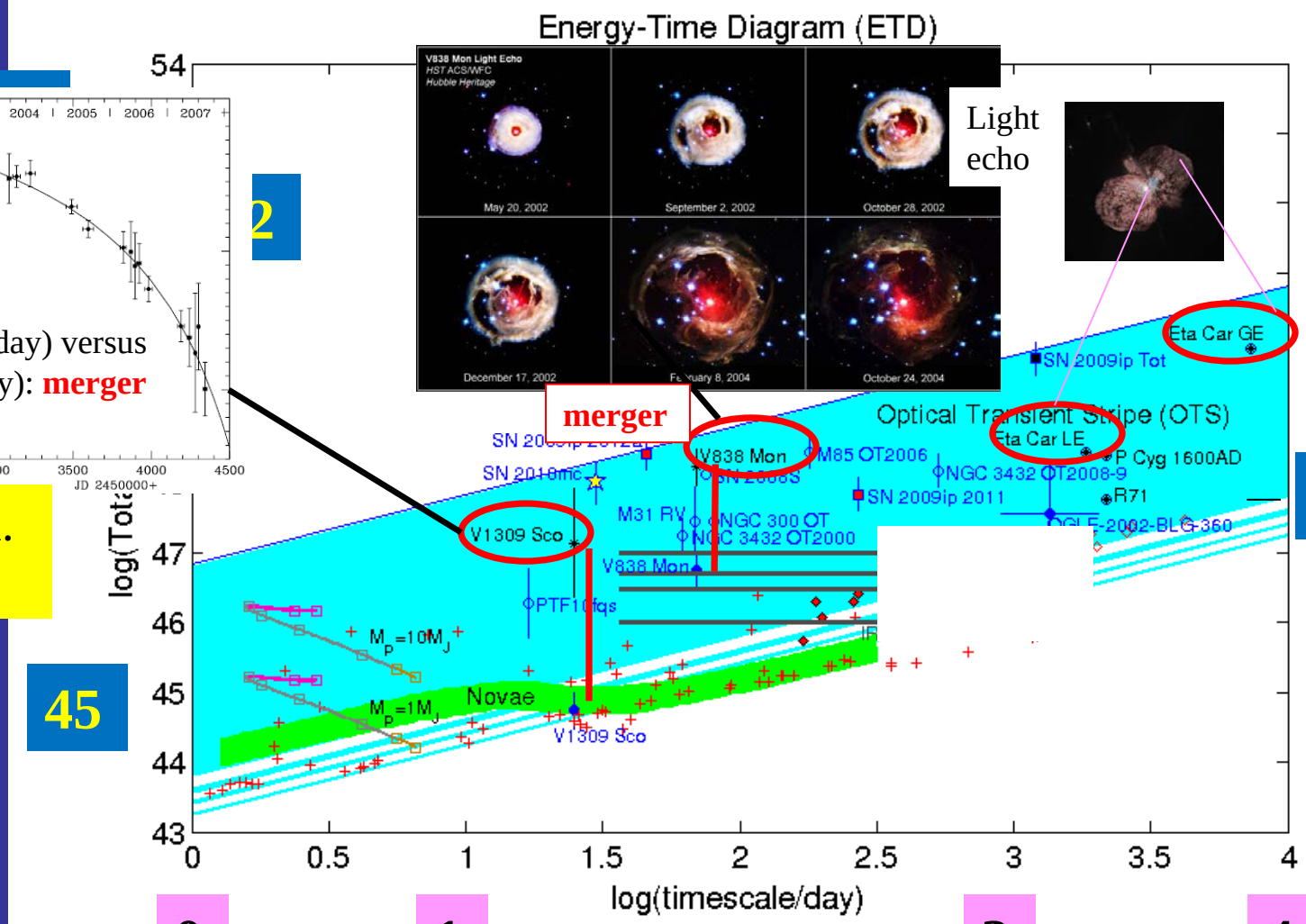
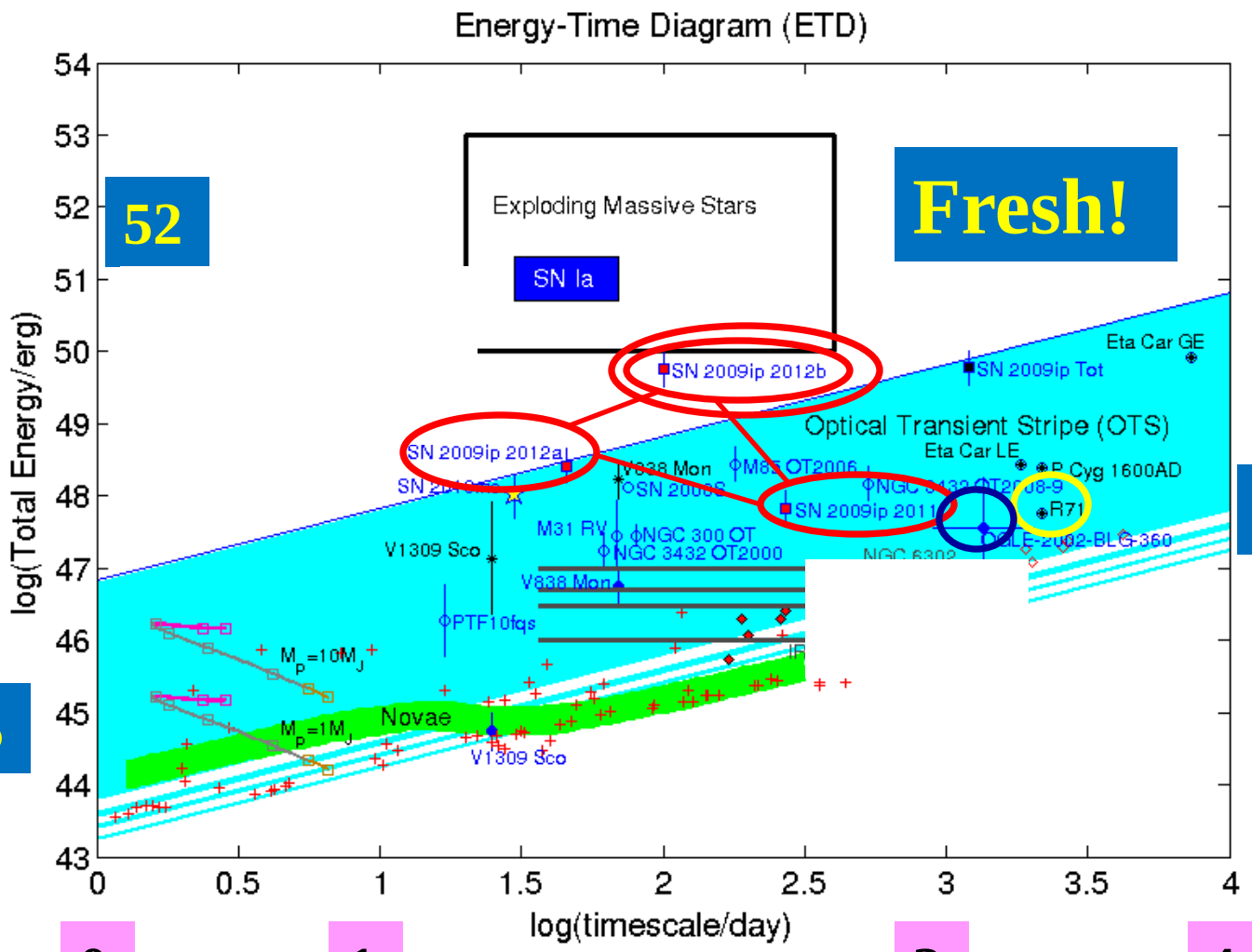
Why cataclysmic variables have no jets?

0 **1** **3** **4**

Log(time/day)


Energy-Time Diagram (ETD)
Light echo
merger
Period (day) versus time (day): merger
Tylenda et al. 2011
Optical Transient Stripe (OTS)
V1309 Sco
V838 Mon
M85 OT2006
NGC 3432 OT2008-9
SN 2009ip 2011
SN 2009ip Tot
Eta Car GE
Eta Car LE
P Cyg 1600AD
R71
M31 RV
NGC 300 OT
NGC 3432 OT2000
PTF10fqs
Novae
log(timescale/day)
log(Tot
2
45
48
0
1
3
4
Log(time/day)

Total (Kinetic +radiation) log(E/erg)



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Fresh!

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Log(time/day)

SN 2009ip:

A SN impostor in 2009—but what about 2012b?

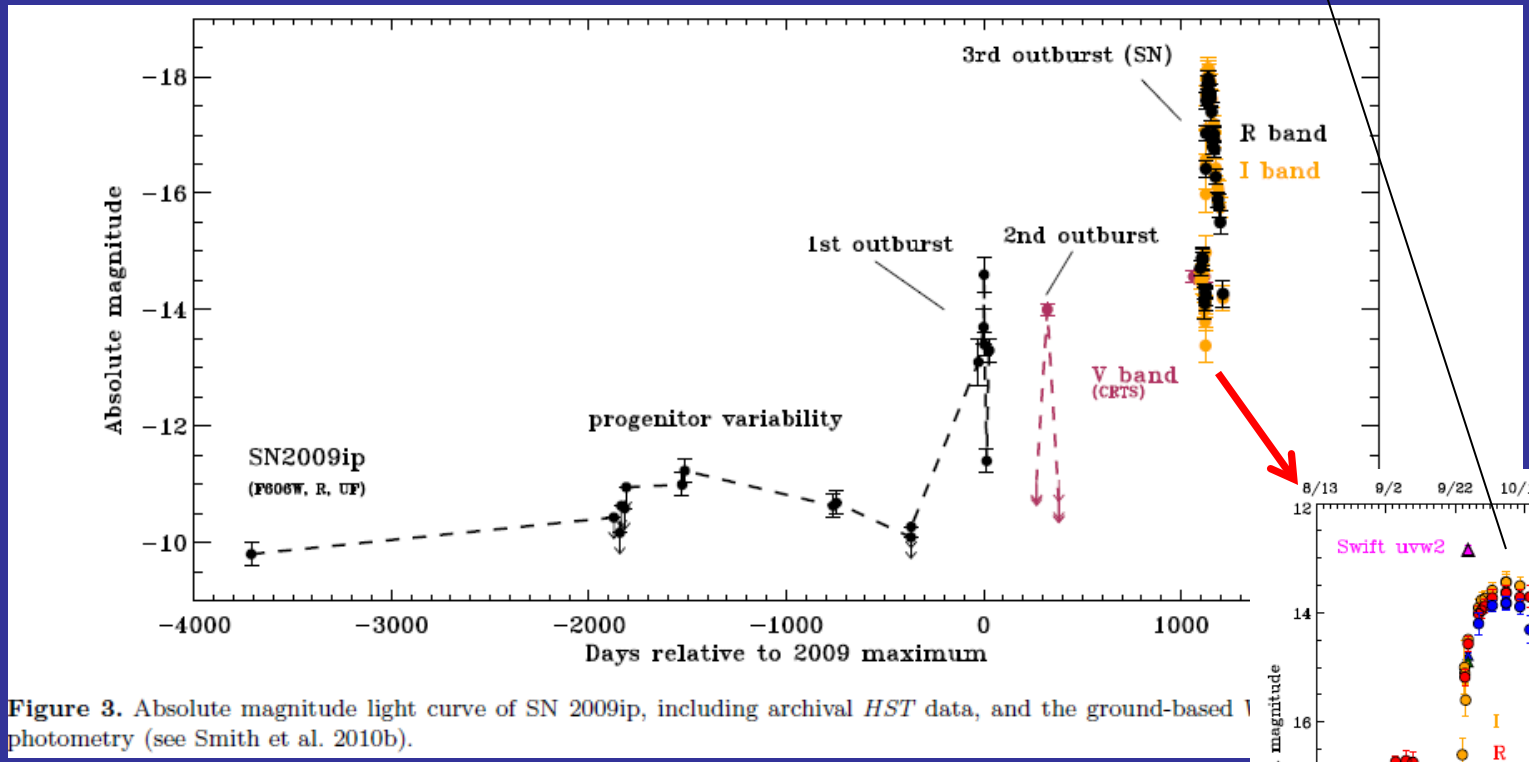
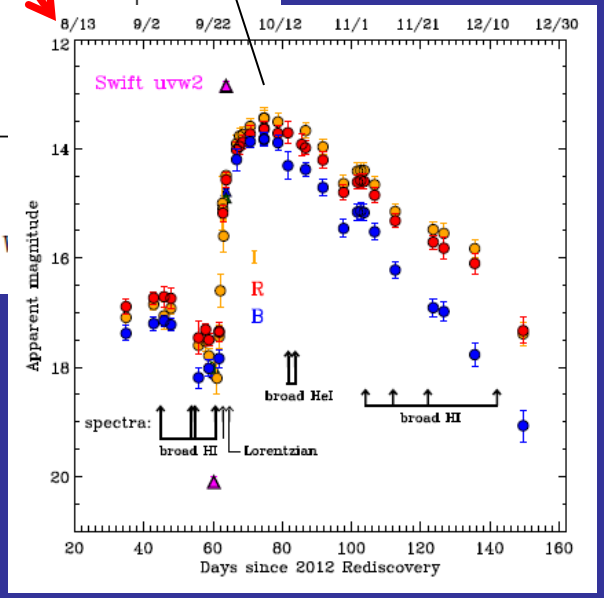
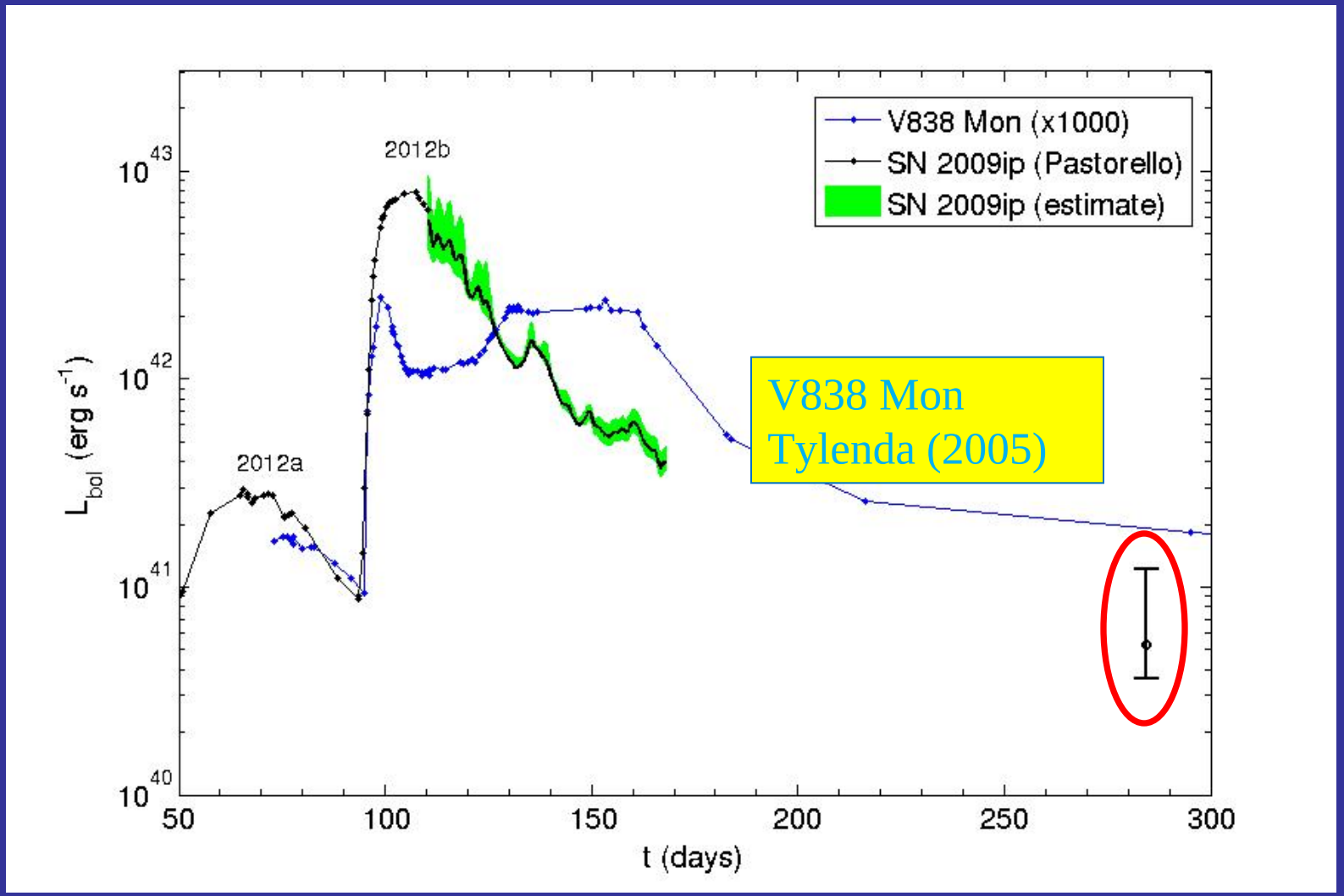


Figure 3. Absolute magnitude light curve of SN 2009ip, including archival *HST* data, and the ground-based V photometry (see Smith et al. 2010b).



From Mauerhan, Nathan Smith et al. 2013


V838 Mon (x1000)
SN 2009ip (Pastorello)
SN 2009ip (estimate)
2012a
2012b
V838 Mon
Tylenda (2005)
L_{bol} (erg s^{-1})
10^{43}
10^{42}
10^{41}
10^{40}
50
100
150
200
250
300
t (days)

We suggest that small peaks are powered by **jets** launched from a companion, as in Eta Carinae.

Margutti et al. (2013). suggest a 38 days typical variation time.
This is compatible with the binary interaction model.

Are the small peaks yet more periastron passages of the companion?

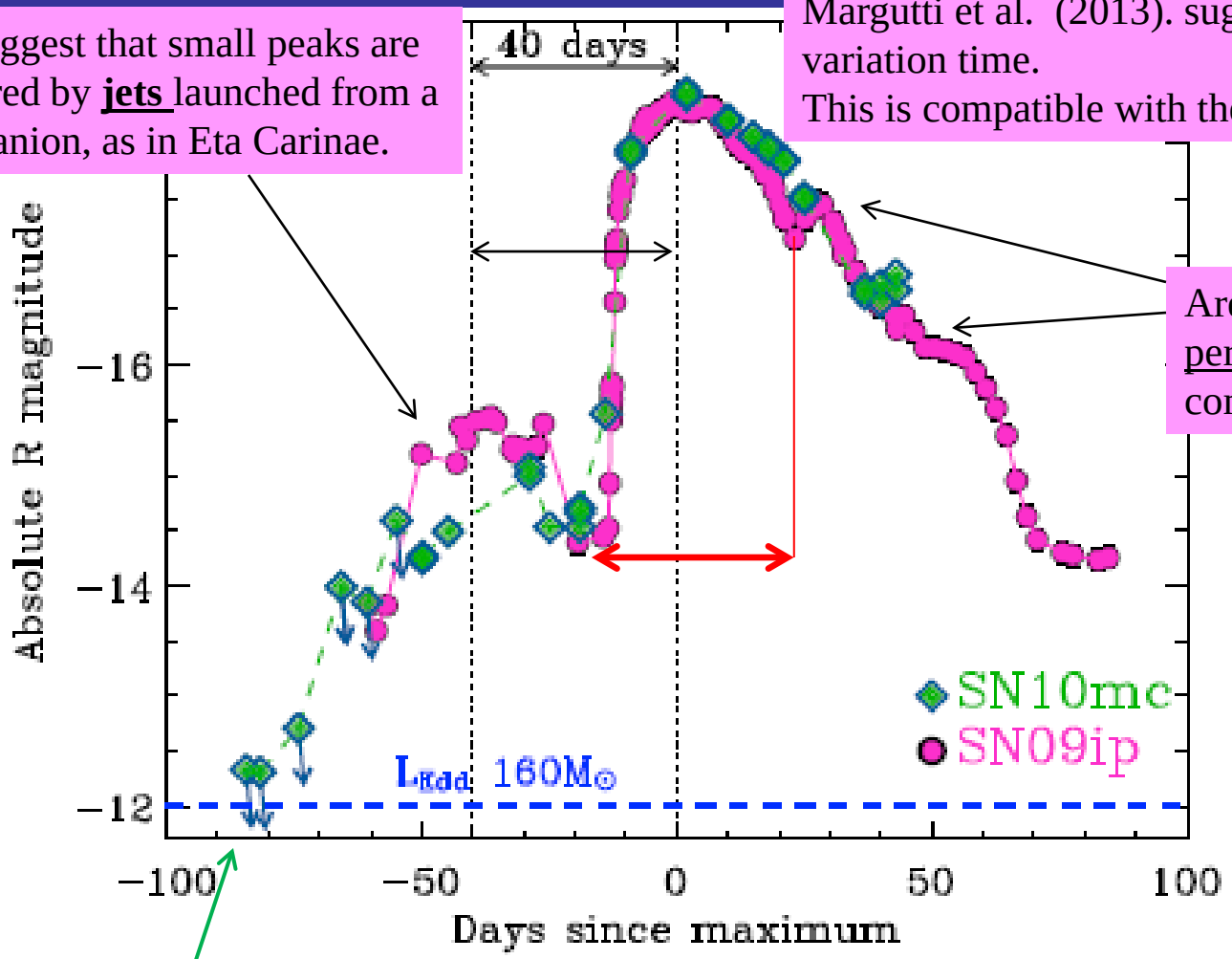
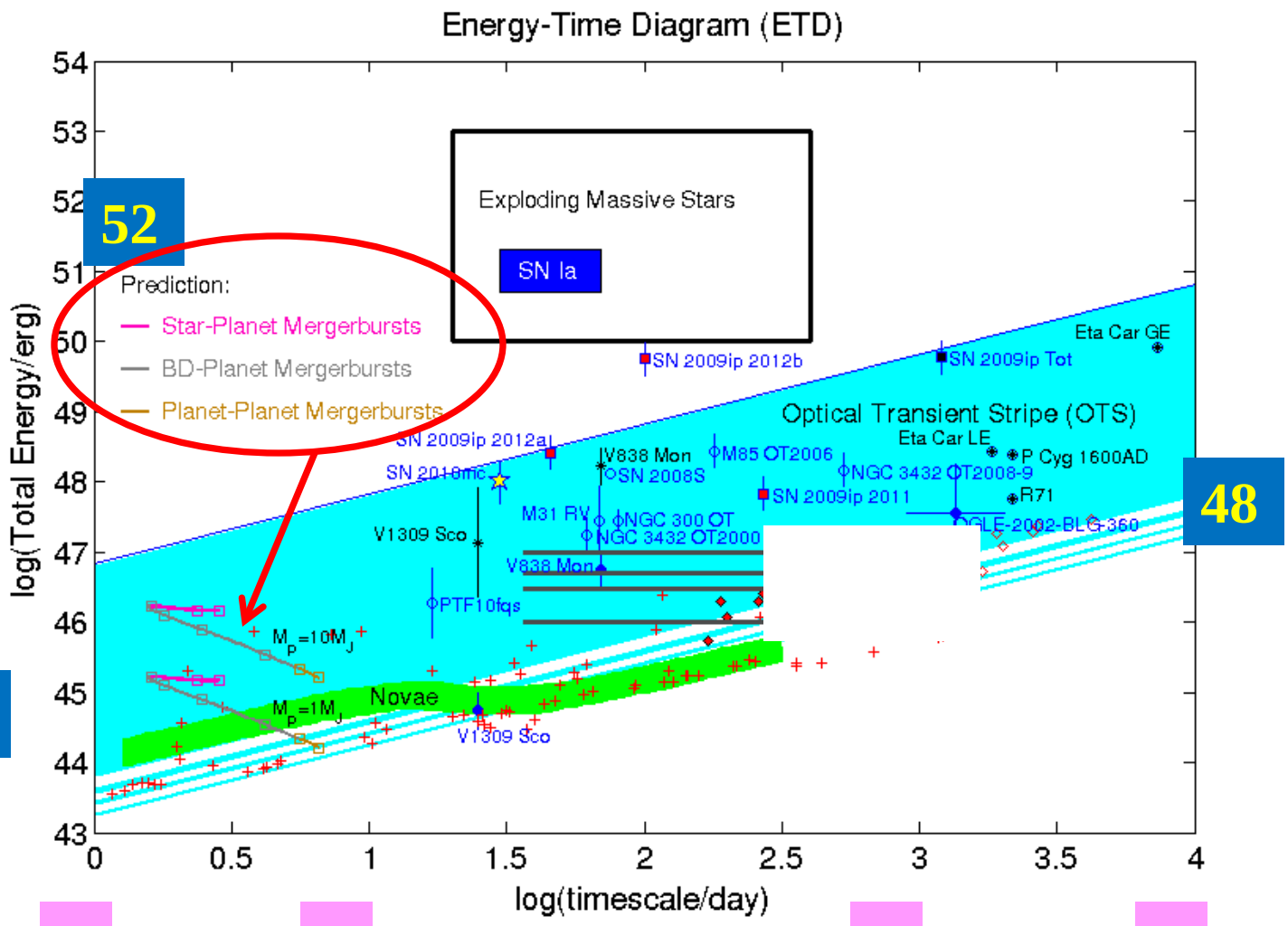


FIG. 30.— The comparison of the absolute R band magnitude of SN 2009ip and Type IIn SN 2010mc (Ofek et al. 2013b) reveals a striking similarity between the two explosions both during the precursor-bump and the major outburst.

Total (Kinetic +radiation) log(E/erg)



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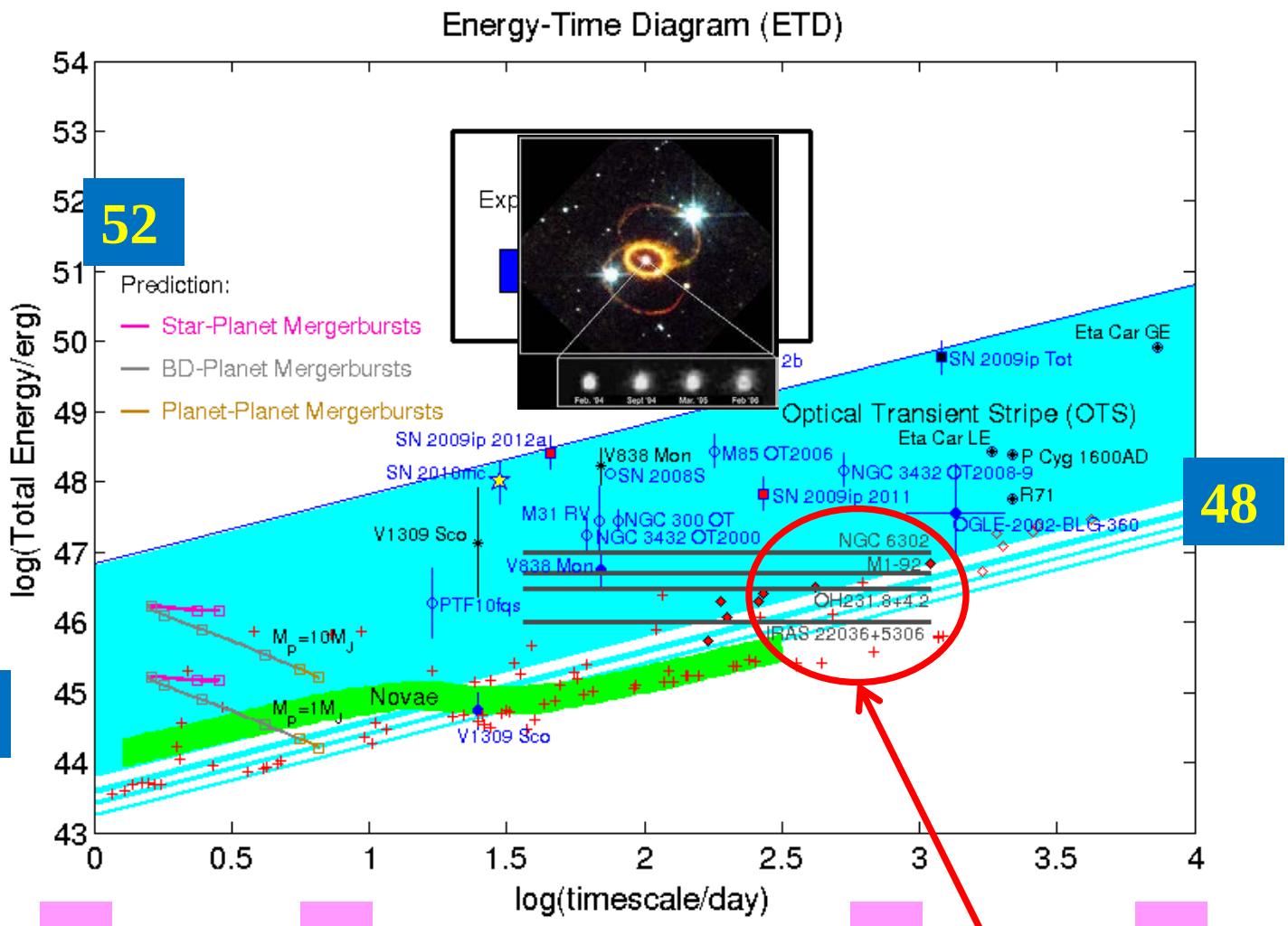
Log(time/day)

Total (Kinetic +radiation) log(E/erg)



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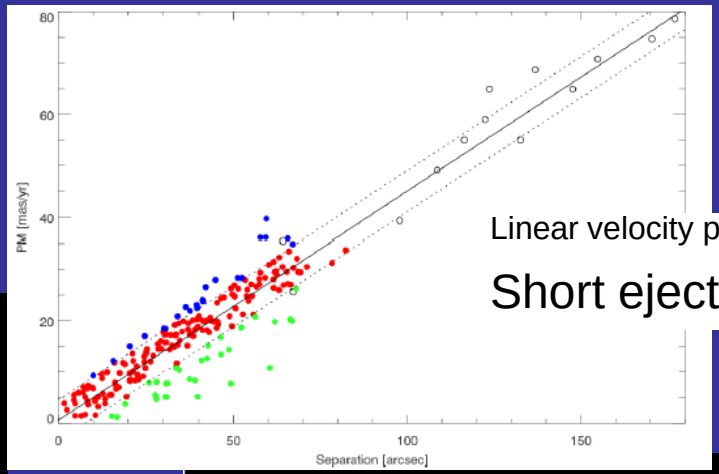
Log(time/day)

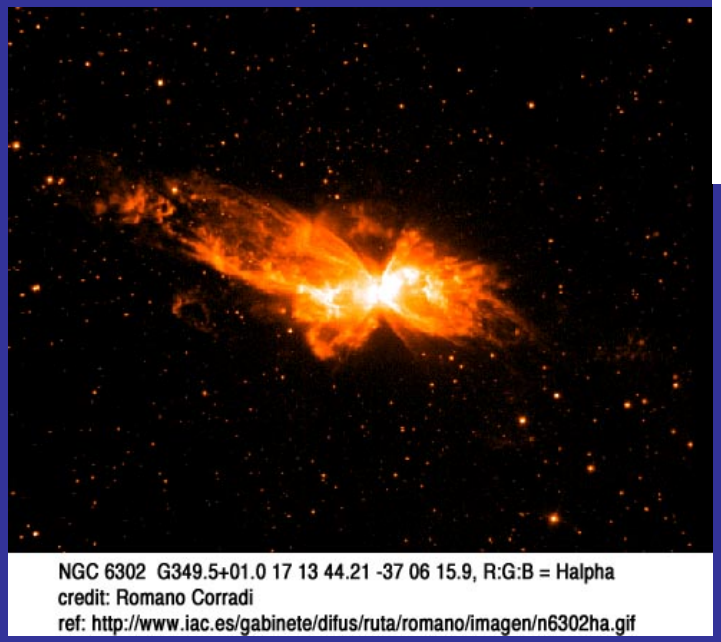
Suggestion (Kashi & soker) : Planetary nebulae and pre-PNe

NGC 6302



Linear velocity position relation:

Short ejection episode.



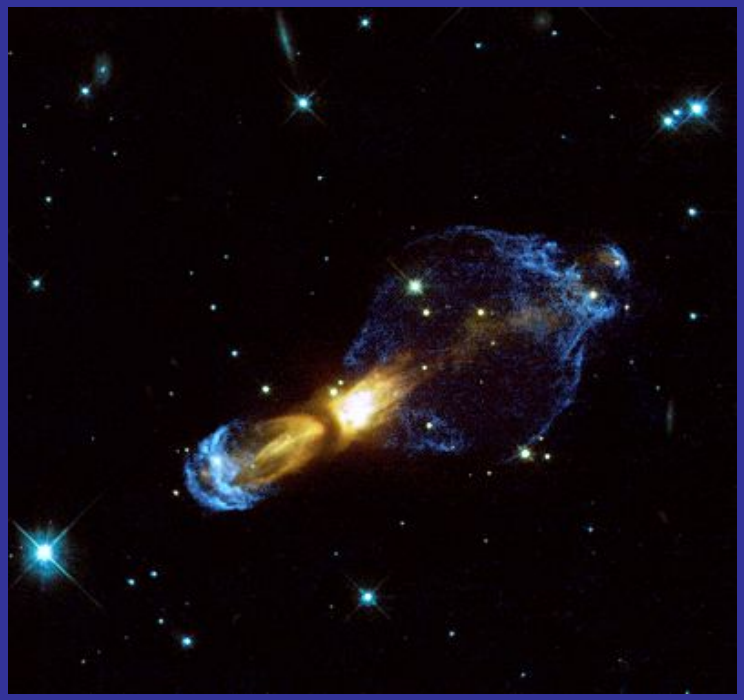
NGC 6302 G349.5+01.0 17 13 44.21 -37 06 15.9, R:G:B = Halpha
credit: Romano Corradi
ref: http://www.iac.es/gabinete/difus/ruta/romano/imagen/n6302ha.gif

Romano Corradi

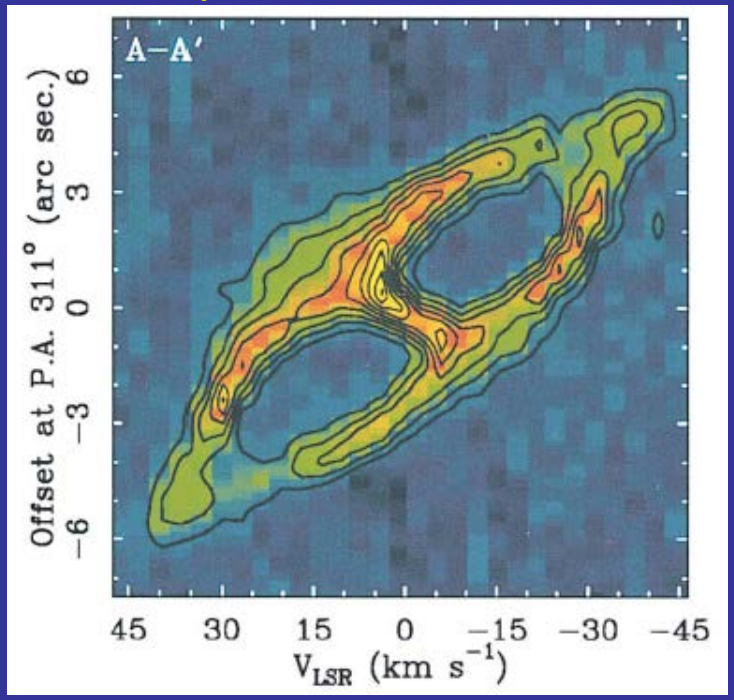
Szyszka, C.; Zijlstra, A. A.; Walsh, J

Shaped by jets

Pre-Pne that formed in a short time:
ILOTs (Red Novae)?



OH231.8+4.2
(Bujarrabal et al. 1998)



M1-92 (Bujarrabal et al. 1998)

Shaped by jets

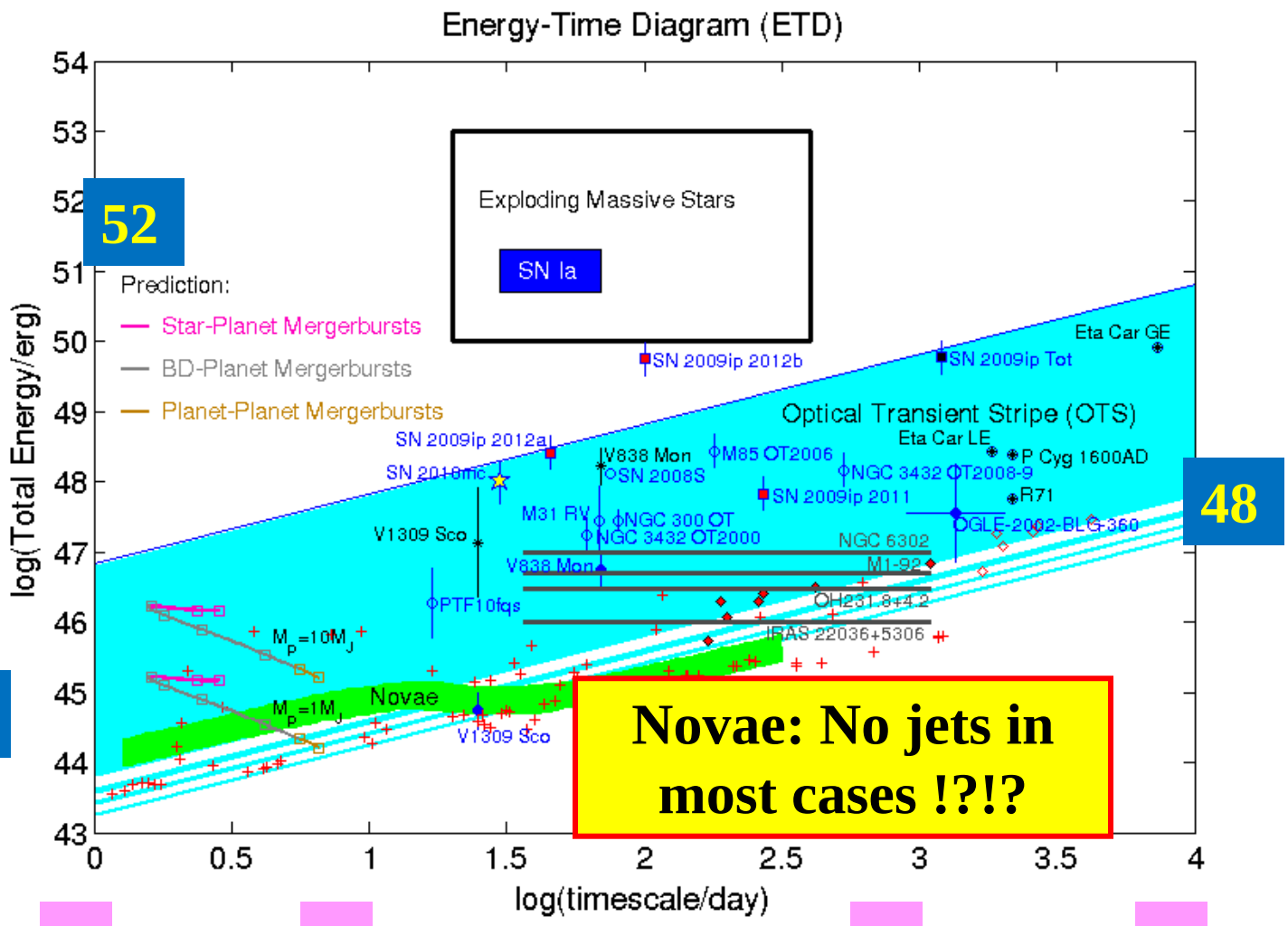
Common to all these objects in the gap is ejection of large quantities of dust

- Progenitors of PNe;
- Mergerbursts;
- SN impostors;
- LBV major eruptions (that seem to be all binaries);
- Other systems with periastron activity

All these objects are power by gravitational energy of mass transfer in binary stars, including merger, which is an extreme case of mass transfer.

Accretion disks, hence jets, are likely to be formed

Total (Kinetic +radiation) log(E/rg)



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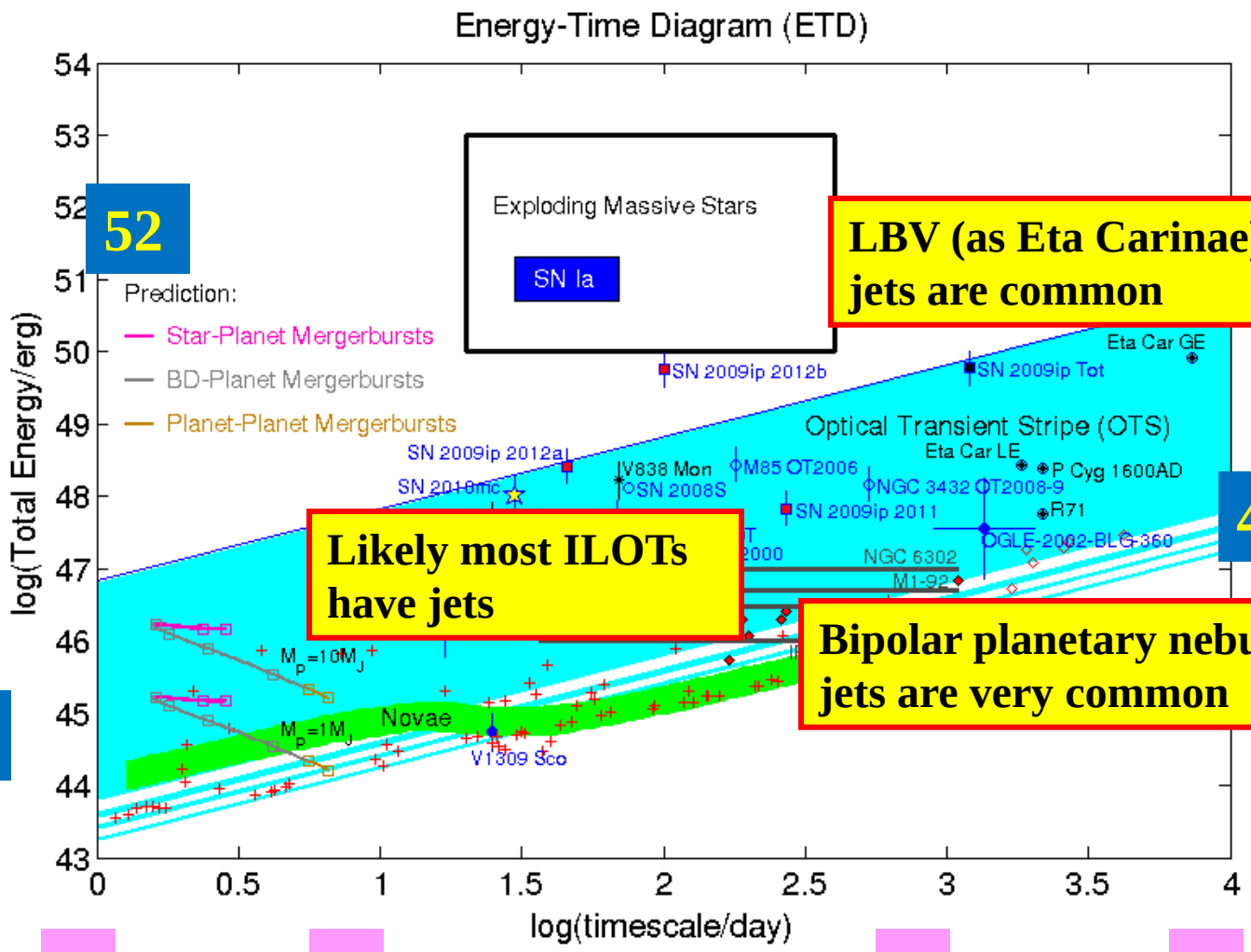
0 **1** **3** **4**

Log(time/day)

Total (Kinetic +radiation) log(E/rg)



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LBV (as Eta Carinae) jets are common

Likely most ILOTs have jets

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Bipolar planetary nebulae: jets are very common

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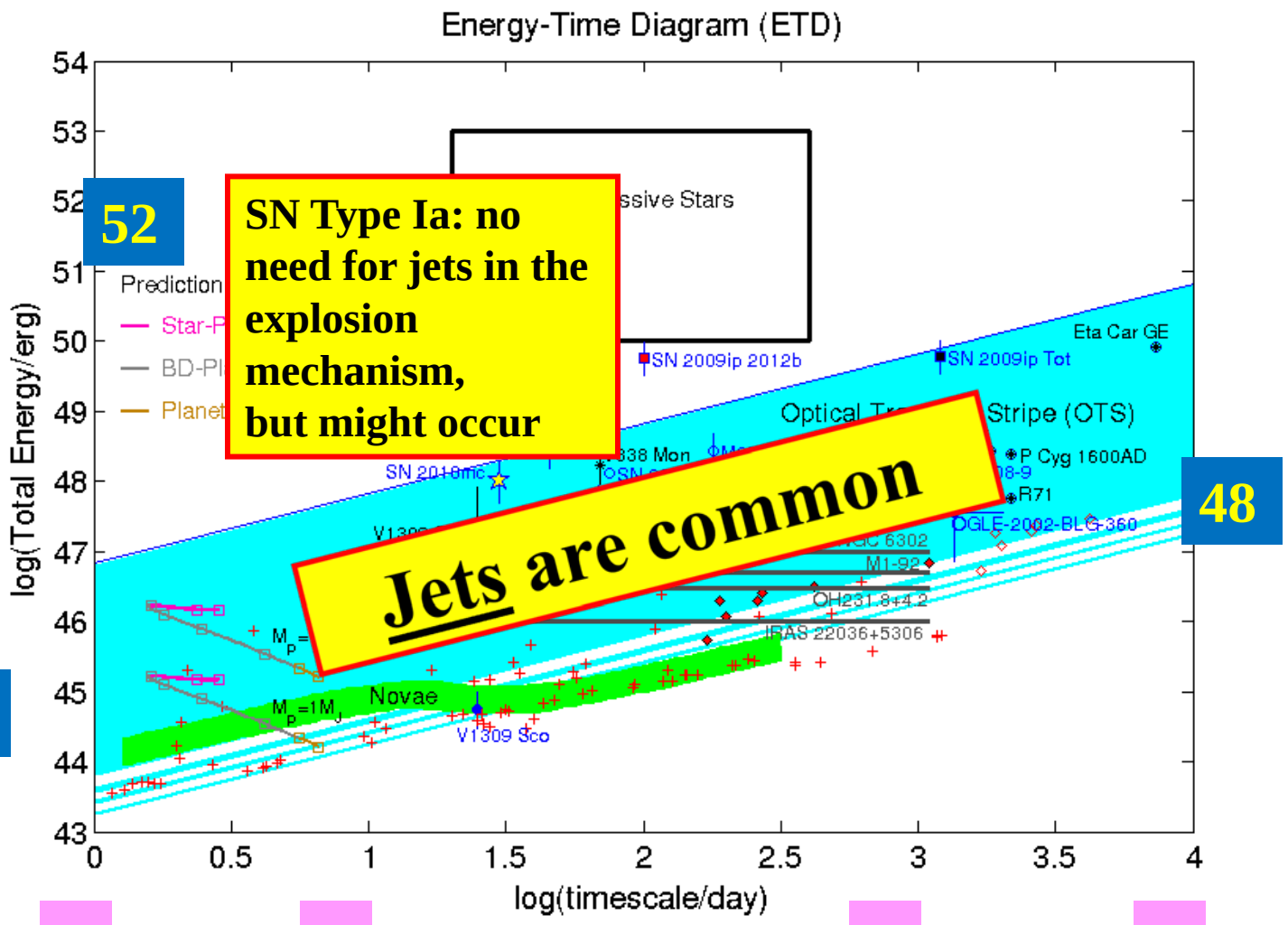
0 **1** **3** **4**

Log(time/day)

Total (Kinetic +radiation) log(E/rg)



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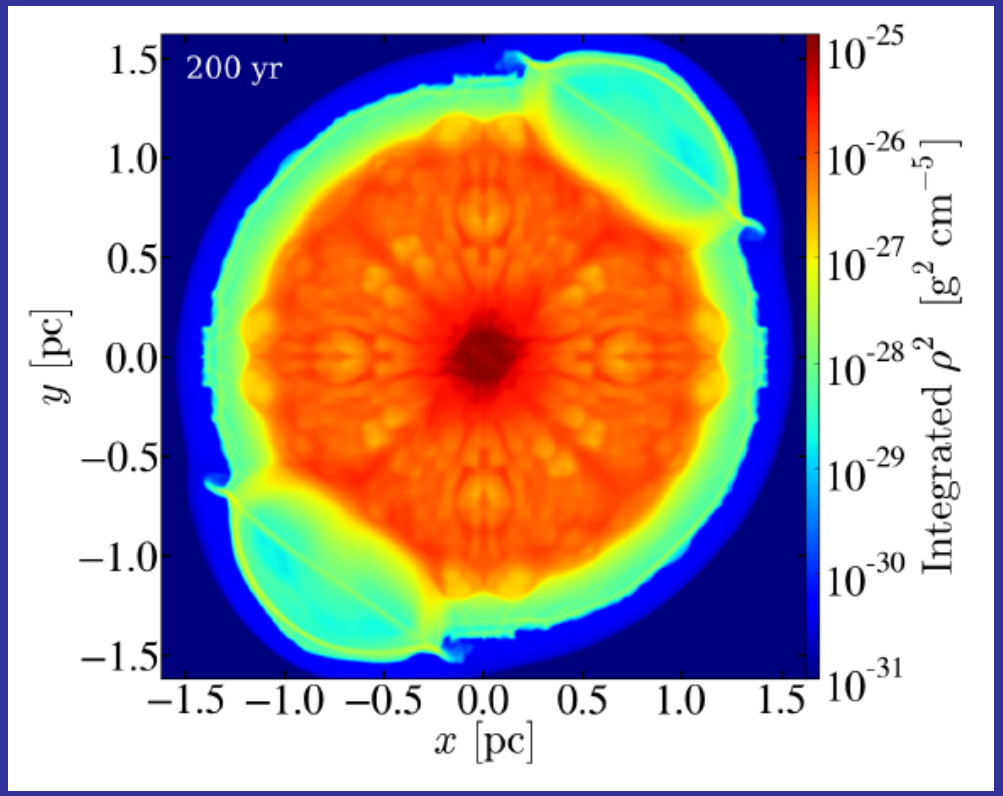
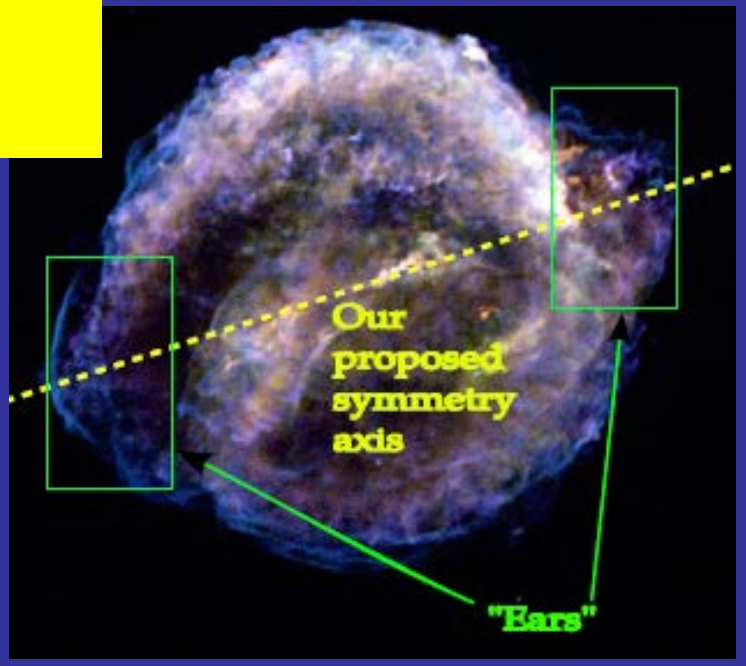
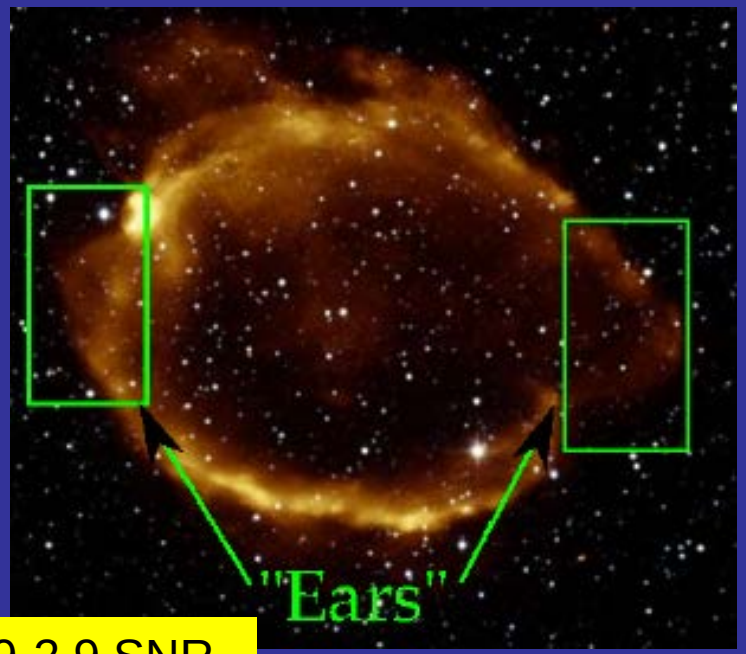
Log(time/day)

JETS !?

Kepler SNR:
~1Mo CSM





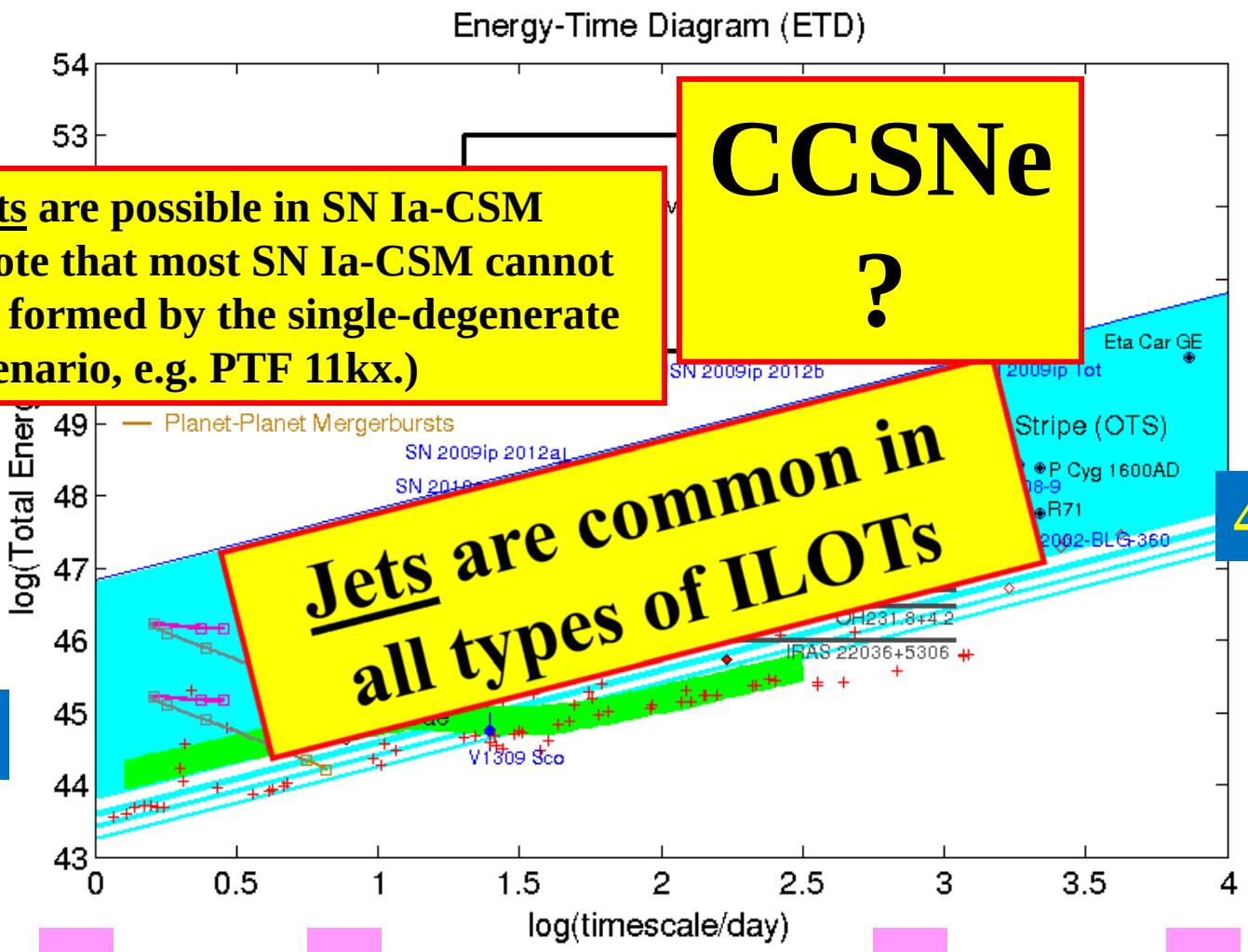


G299-2.9 SNR

Total (Kinetic +radiation) log(E/rg)

Jets are possible in SN Ia-CSM (note that most SN Ia-CSM cannot be formed by the single-degenerate scenario, e.g. PTF 11kx.)

CCSNe ?



Jets are common in all types of ILOTs

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0 **1** **3** **4**

Log(time/day)

Our model (with two PhD students):

All core collapse SNe (CCSNe) are exploded by jets launched from the newly formed neutron star or BH.

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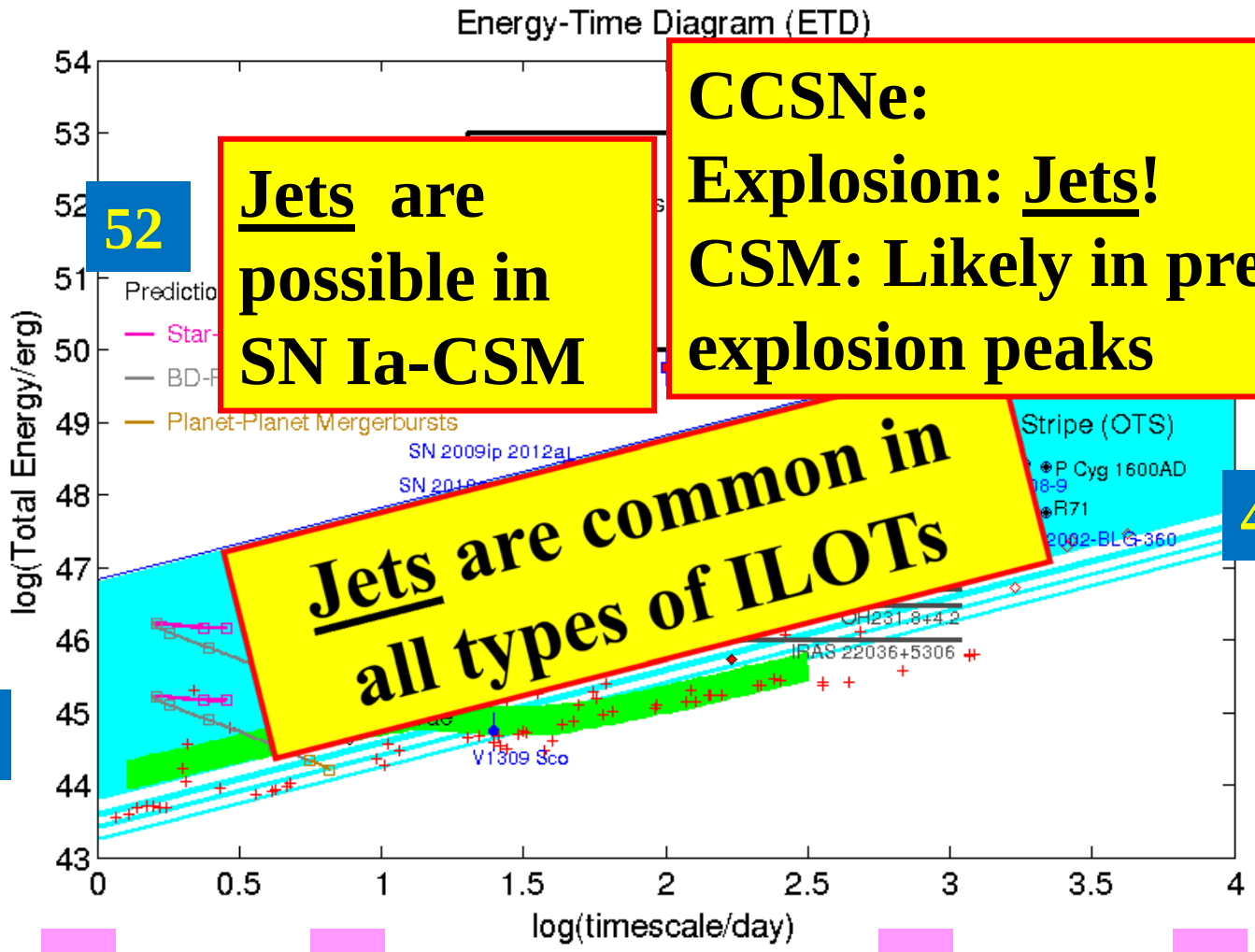
All core collapse SNe (CCSNe) are exploded by jets launched from the newly formed neutron star or BH.

Results from 2013: New 3D simulations show, as expected from analytical estimates, that neutrino mechanisms cannot explode CCSNe.

Total (Kinetic +radiation) log(E/rg)

52

45



Jets are possible in SN Ia-CSM

CCSNe: Explosion: Jets! CSM: Likely in pre-explosion peaks

Jets are common in all types of ILOTs

48

0 1 3 4

Log(time/day)

SUMMARY