Running stars

Mathieu Renzo
The big dipper
North Star (Polaris)

The big dipper
The big dipper as eyesight test for ancient astronomers
The big dipper as eyesight test for ancient astronomers
Unlike the Sun

Most stars are binaries
(or triples, quadruples, etc...)
Where are stars born?
Stellar “nurseries” are crowded places
Stellar “nurseries” are crowded places: encounters can happen!

Credits: C. Rodríguez
Typical result:

One star runs away
(the smallest of the three)

The two biggest stars pair together
Typical result:
Actual scientific terms!

Runaway star

speed $\gtrsim 70,000$ mph

“Bully binary”

Fuji & Portegie-Zwart 2011
How can we find runaways and “bully” binaries?

We need space telescopes to track how stars move.

Anyone can download the data!
The biggest runaway star known
The most massive runaways known is more than $140 \times$ the Sun
The most massive runaways known is more than $140 \times$ the Sun

R136

VFTS682

VFTS16

VFTS72

Renzo et al. 2019a

Lennon et al. (incl. MR) 2018
Conclusions
• Stars are not always alone – many are binaries
• Stars and binaries can “encounter” each other
• Binaries can swap members and eject “runaway” stars
• Stars are not always alone – many are binaries
• Stars and binaries can “encounter” each other
• Binaries can swap members and eject “runaway” stars
• You can see some by naked eye!

Orion

Betelgeuse
Backup slides
What is a star?
The nearest star to us is the Sun
Stars are large balls of matter that “resist” their own weight.

Pushing against gravity costs energy.
Stars produce their own energy by nuclear fusion.

Pushing against gravity costs energy

⇓

To produce energy, stars create new elements

⇓

They run out of “fuel” and are forced to evolve.
Bow shocks
Looking at how stars move is the oldest form of astronomy...

... but it still yields surprises today!