The long-period eccentric orbit of the particle accelerator HD167971 revealed by long baseline interferometry

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Outline

- Scientific context
- Our results in a few words
- Our results in the relevant scientific context
- Concluding remarks

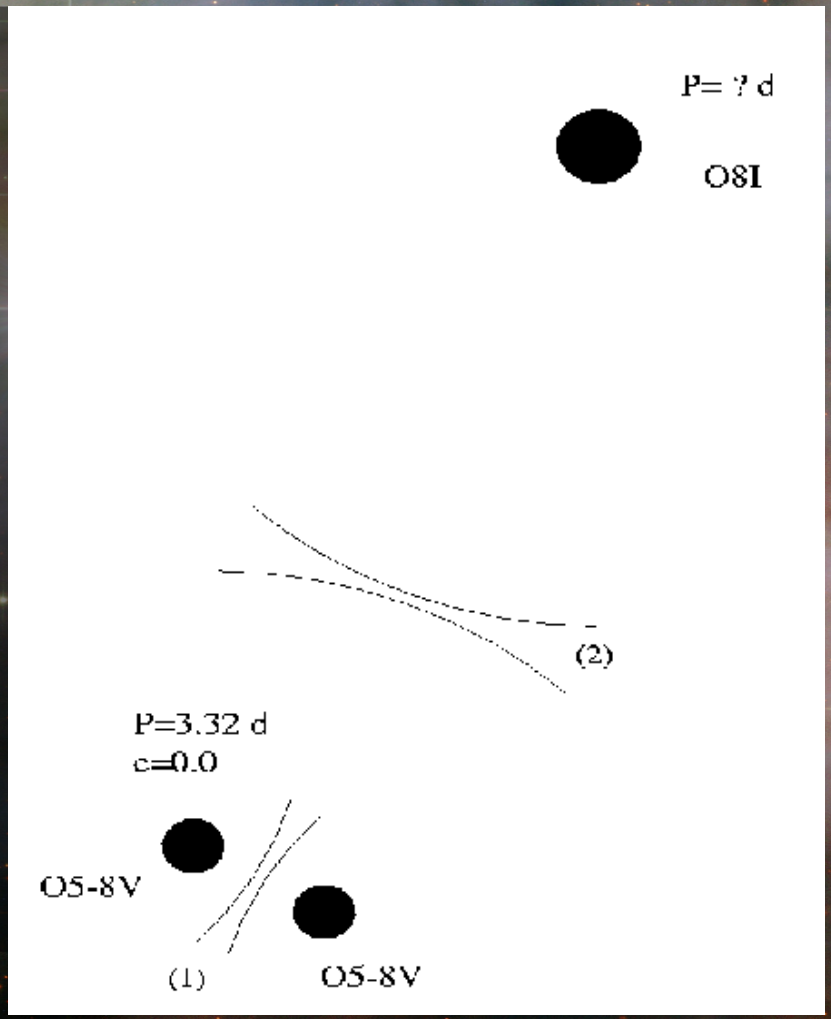
Scientific context

HD167971 in the relevant scientific context:

Massive system containing a close binary and a third star.
(Leitherer, Forbes, Gilmore et al. 1987)

Synchrotron radio emission from a wind-wind interaction
(Blomme, De Becker, Runacres et al. 2007)
--> particle acceleration

X-ray properties suggesting a thermal component coming from a wind-wind interaction in a wide orbit.
(De Becker, Rauw, Blomme et al. 2005)



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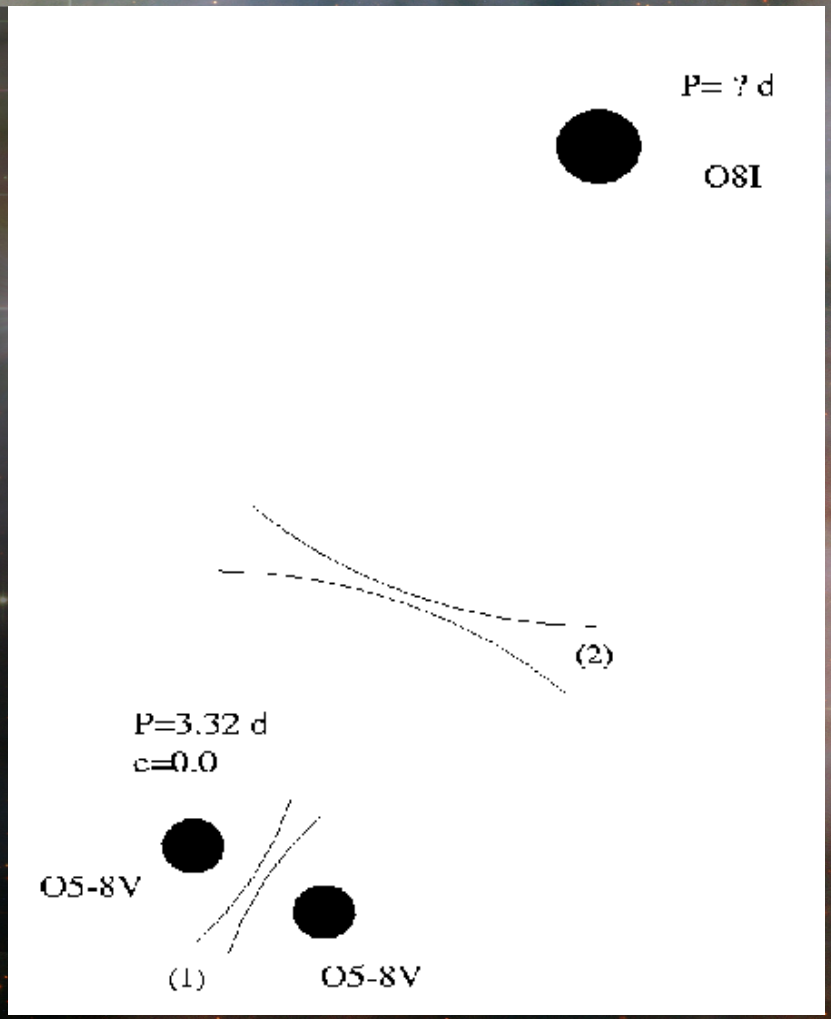


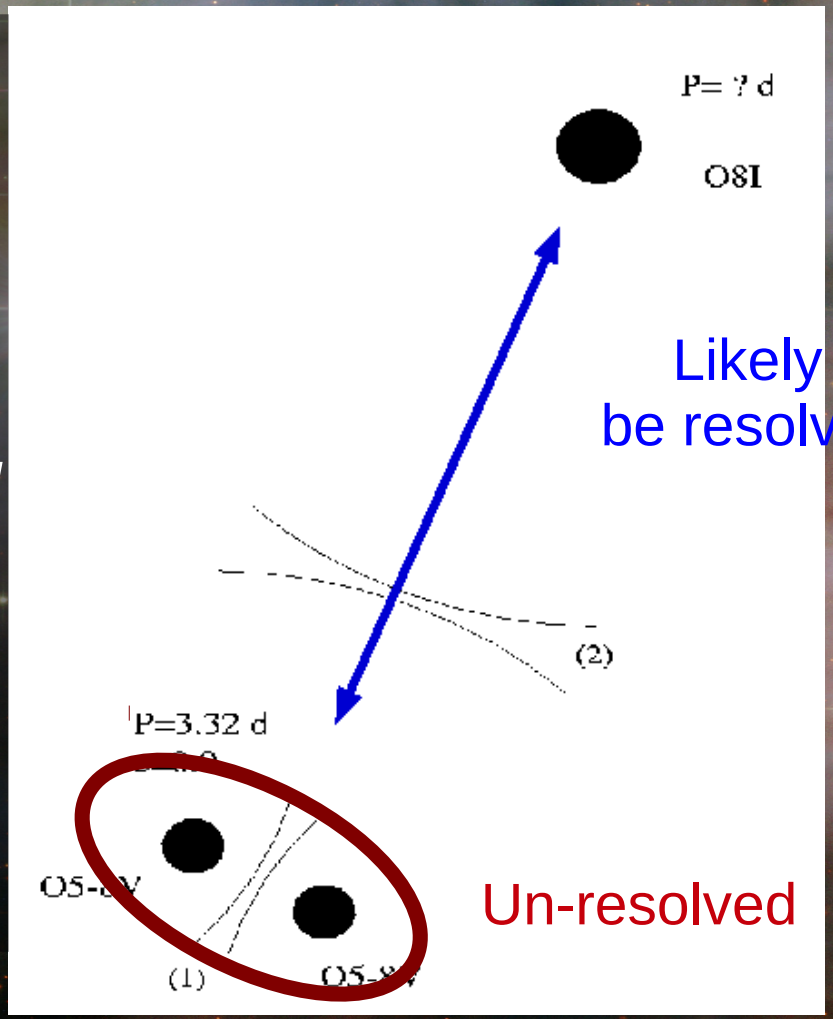
Scientific context

HD167971 in the relevant scientific context:

Aims of the VLTI campaign:

- resolve two components in the system
- search for evidence of an orbital motion
--> evidence for a gravitational link between the third star and the close binary

- measure the flux ratio
--> derive constraints on the classification

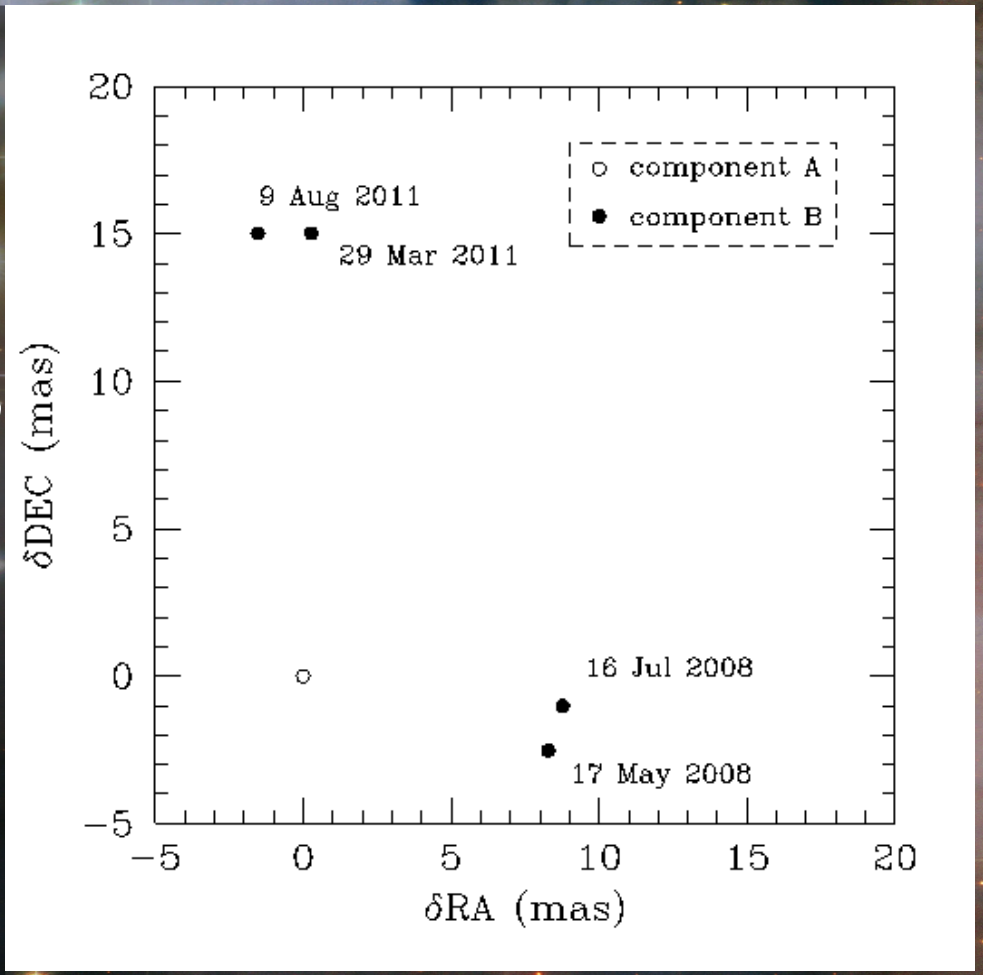


Results

1. Two components have been resolved (8 – 15 mas)

2. The relative positions of the components changed significantly from one epoch to the other
*--> **evidence for a gravitational link***

3. Flux ratios have been measured to be ~ 0.8
--> discussion of the classification possible

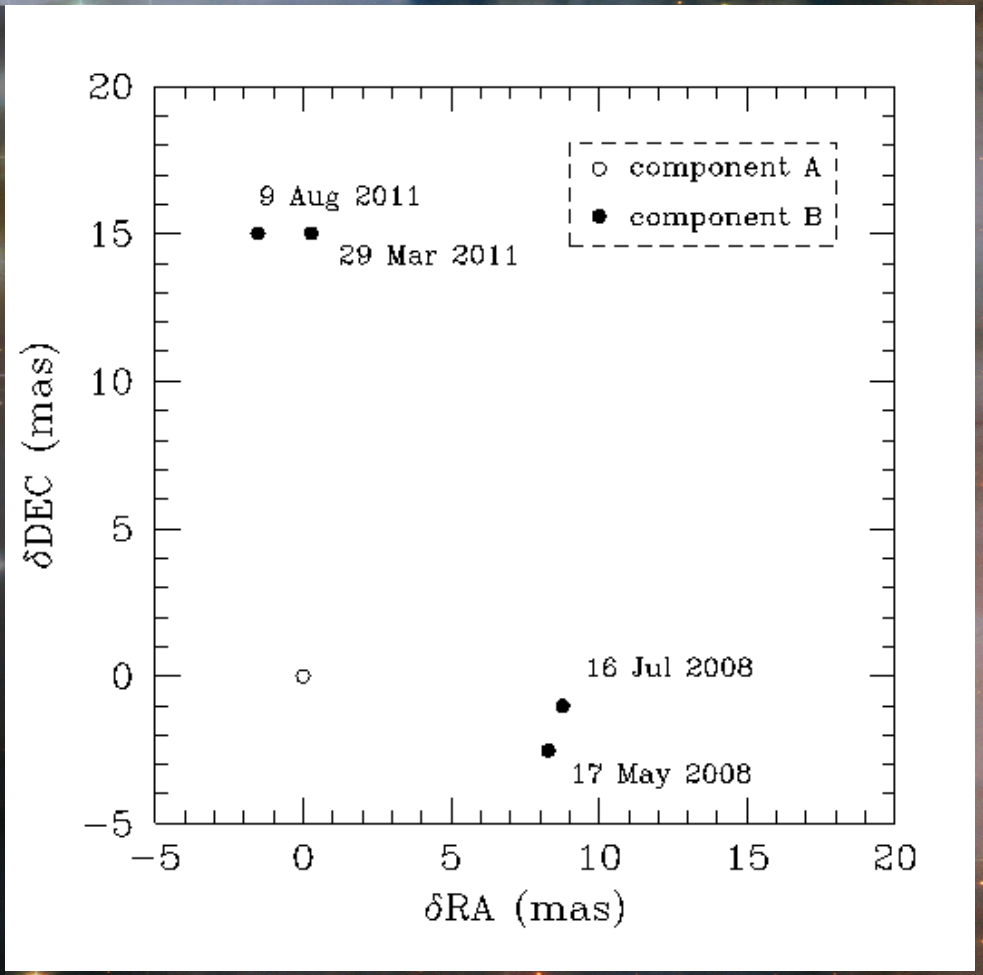


Results in their scientific context

1. The orbit

Significant changes in the angular separation
--> rather large eccentricity (e > 0.5)

Weak changes (although significant) in the relative position on rather short time-scales
--> periastron passage rather close to the observation dates

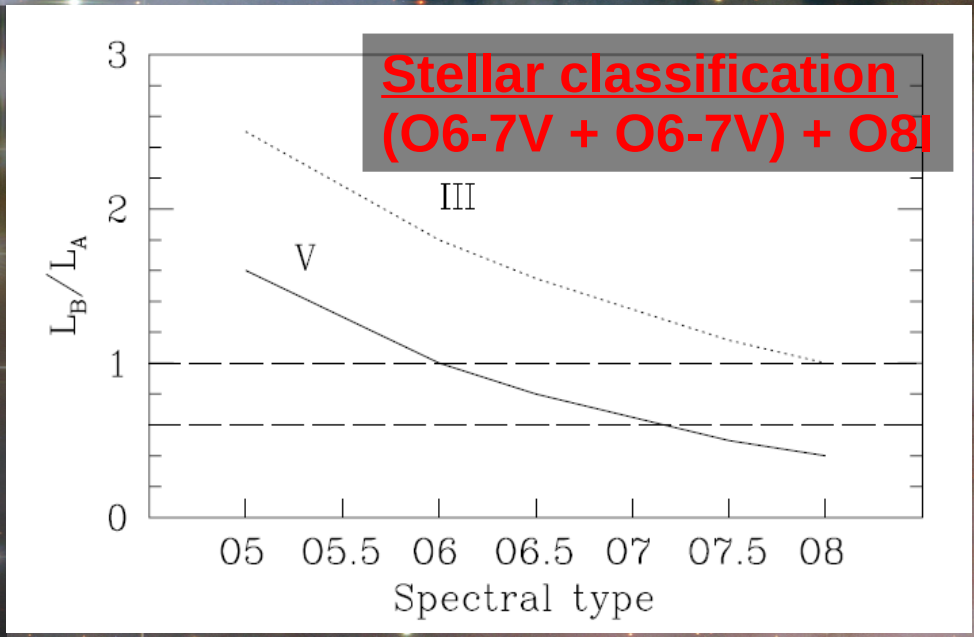


(De Becker et al., MNRAS, to be submitted soon)

Results in their scientific context

2. Stellar classification

Typical luminosity ratio assuming different stellar classifications for the close binary components (for an O8I third star)
--> constraints on the range of admissible spectral types and hints in favor of main-sequence objects



Sp. type	O5V	O5.5V	O6V	O6.5V	O7V	O7.5V	O8V
L_{BOL} ($L_\odot$)	3.2×10^5	2.6×10^5	2.0×10^5	1.6×10^5	1.3×10^5	1.0×10^5	0.8×10^5
L_B/L_A	1.60	1.30	1.00	0.80	0.65	0.50	0.40
Sp. type	O5III	O5.5III	O6III	O6.5III	O7III	O7.5III	O8III
L_{BOL} ($L_\odot$)	5.0×10^5	4.3×10^5	3.6×10^5	3.1×10^5	2.7×10^5	2.3×10^5	2.0×10^5
L_B/L_A	2.5	2.15	1.80	1.55	1.35	1.15	1.0

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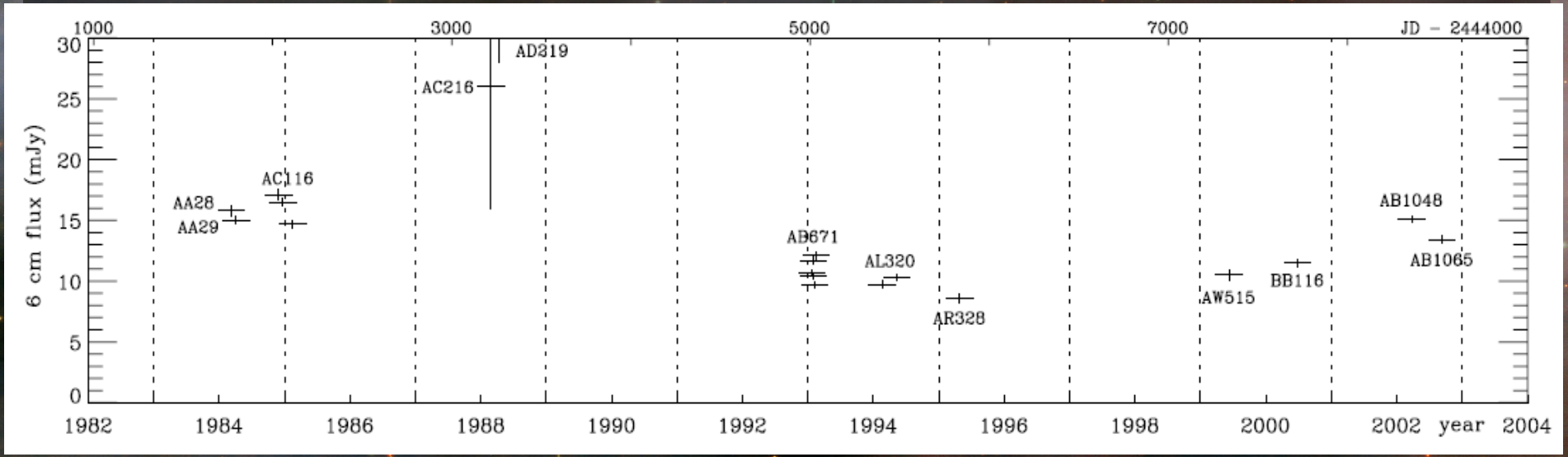
Results in their scientific context

3. Interpretation of the variable synchrotron emission

The radio light-curve suggests a period of ~ 20 yr. The maximum is expected to take place close to periastron passage (but ! Modulation by other effects)

The maximum took indeed place about 20 years before the VLTI observations --> results compatible with a periastron passage close to the dates of our observations



Blomme, De Becker, Runacres et al. 2007

Concluding remarks

We provided evidence for a long-period eccentric outer orbit in HD167971.

We derived constraints on the stellar classification of the components.

Our results provide an adequate interpretation context for phenomena studied at other wavelength, especially the variable synchrotron radio emission.

These observational results are important in the context of the physics of particle acceleration in colliding-wind binaries.

A long term campaign devoted to this target has started...
... See you in about 20 years for the full orbit!