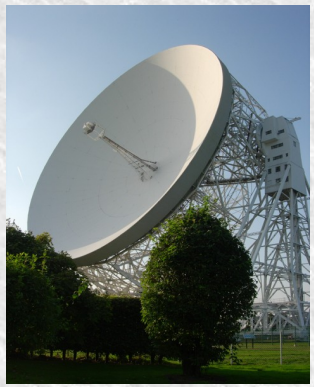
Radio Emission from Massive Stars

By

Diane Brookes
Part-time PhD Student at
The University of Birmingham
Supervisor:
Dr Ian Stevens



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Introduction

Radio emission from massive stars

The COBRaS e-Merlin survey of Cygnus OB2

The BOSS search for bow shocks around massive stars

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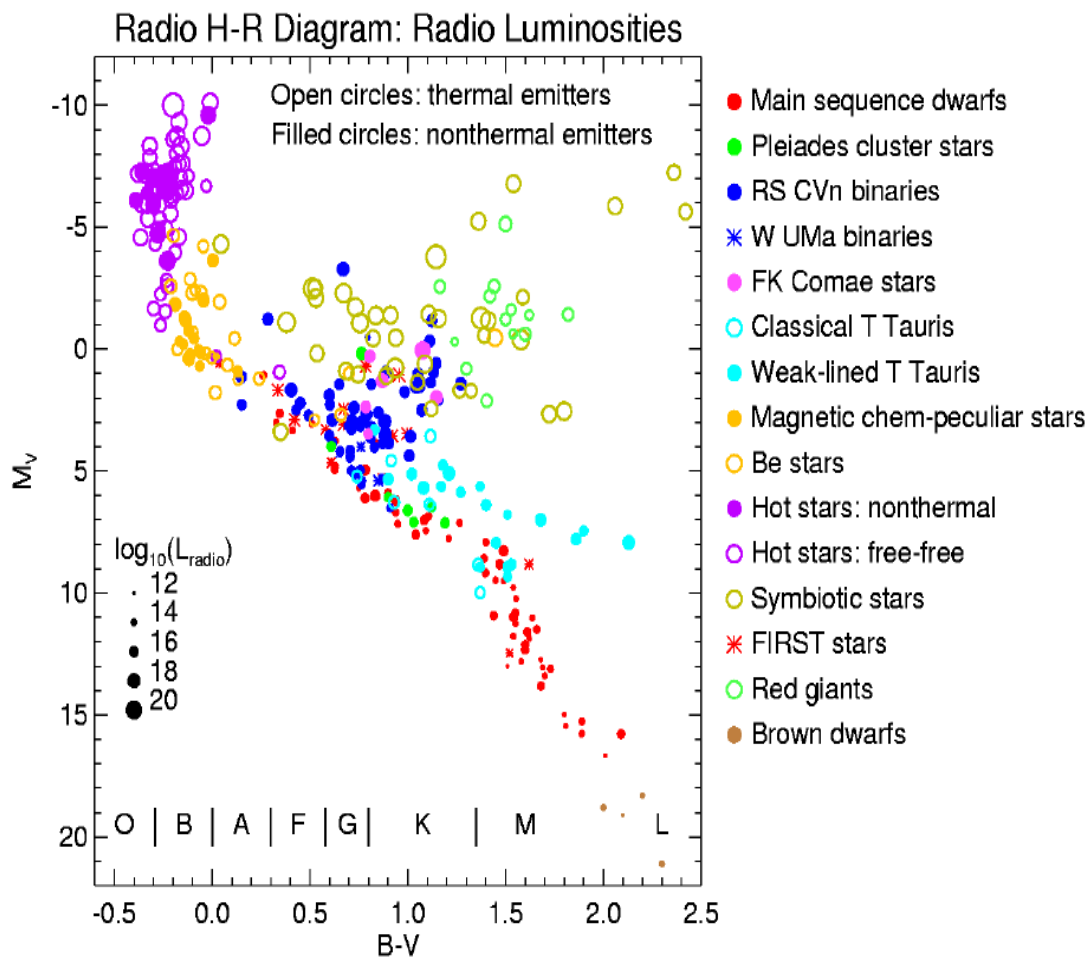
Massive Stars

- Massive stars are OB early type stars found in the top left of the H-R diagram
- They have strong stellar winds and large mass-loss rates → radio emission
- The current estimates of mass-loss have substantial discrepancies



http://www.astro.umd.edu/~white/images/radio_hr_diag_full.htm
link from website of: Stephen White, University of Maryland

Radiation Driven Stellar Winds

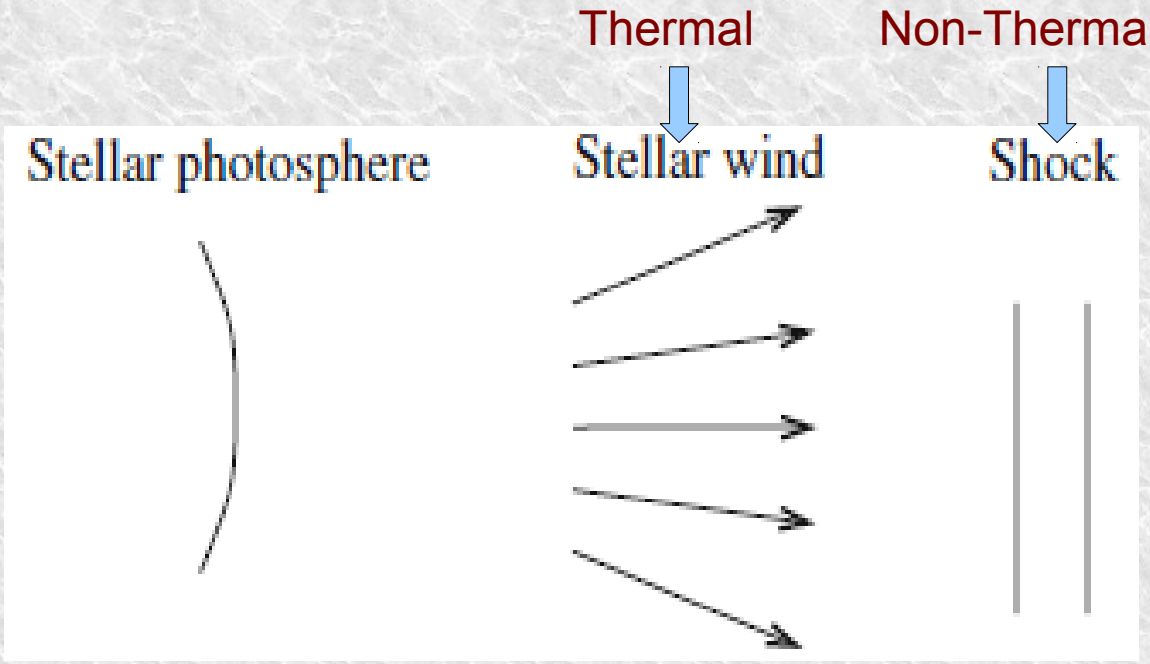
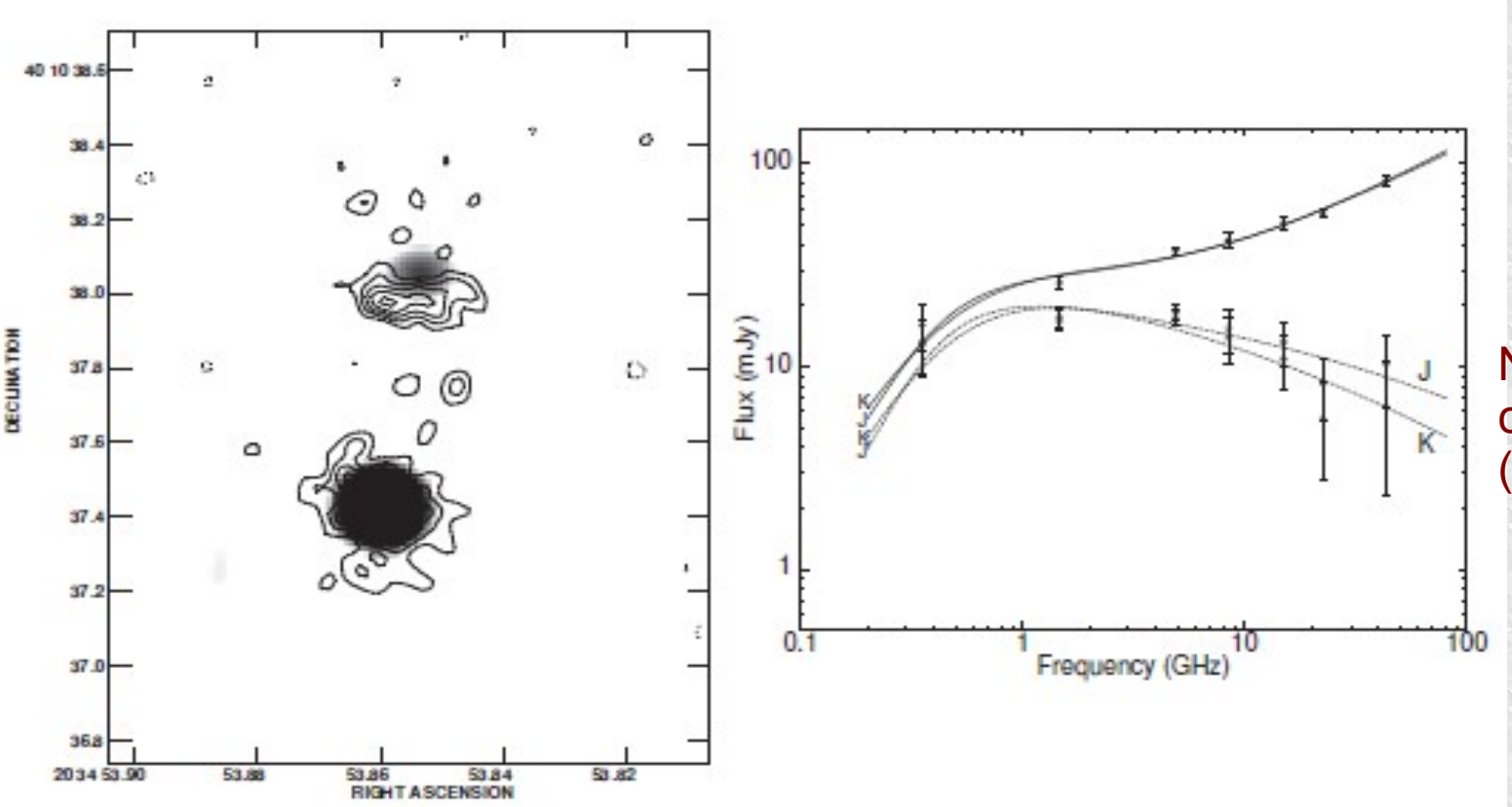


Figure showing stellar winds (De Becker, 2007)

Mass-loss rates of 10^{-7} to 10^{-4} $M_\odot$ yr^{-1}

Wind velocities of 2000 to 5000 km s^{-1}

Thermal & Non-Thermal Emission of WR147



Total emission (solid)

Non-thermal components (open)

MERLIN 5GHz; contours
UKIRT 2.2μm; grey scale

(Dougherty, 2010; Williams et al, 1997)

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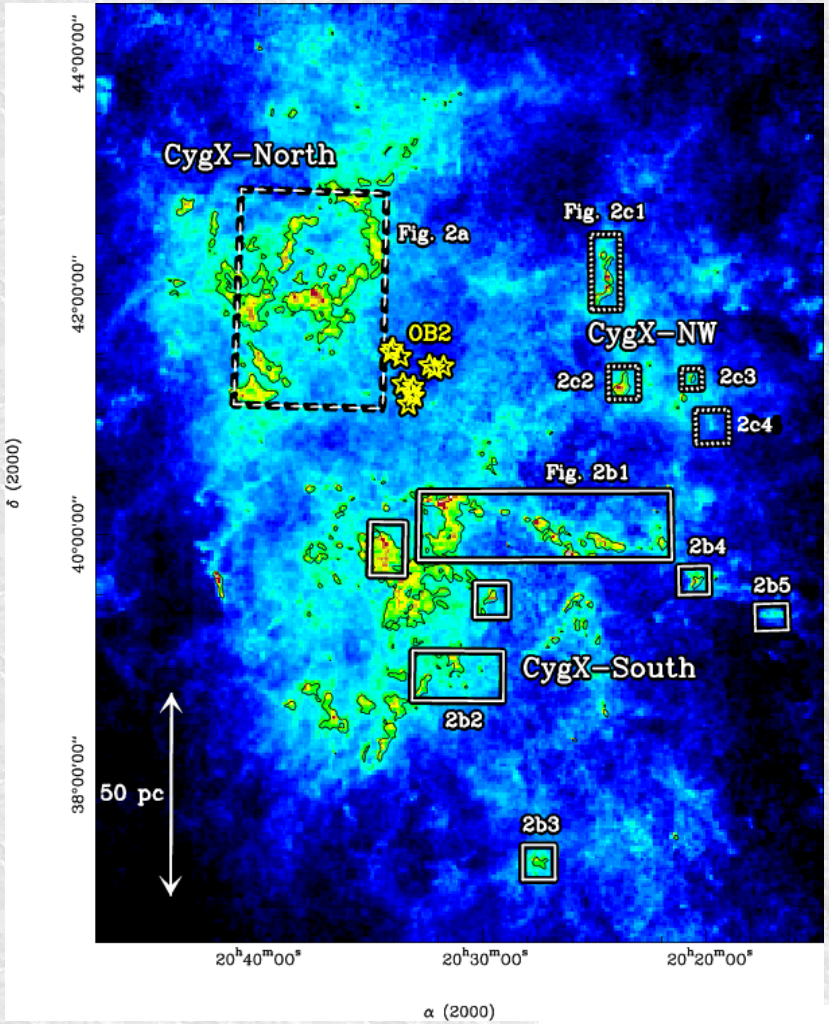
The Cygnus OB2 Cluster

- Nearby cluster 1.2 – 1.8 kpc
- Young ~2-3 Myr
- Cluster Mass ~ 4-10 x 10^4 $M_\odot$
- Large extinction 4-10 mag
- Contains ~120 O type, 2600 OB type stars
- Can be thought of as a young globular cluster

Extinction Map of Cygnus X Region



Motte et al, 2007

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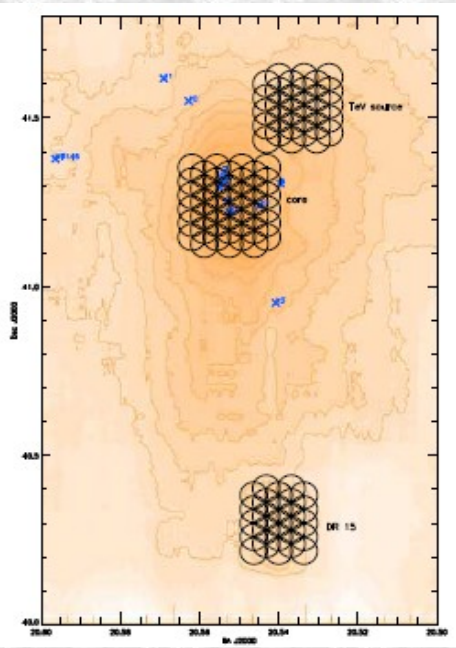
The e-MERLIN Cyg OB2 Radio Survey (COBRaS)

PI: R. Prinja, UCL



Using the high resolution and sensitivity of e-MERLIN to produce a census of the cluster. Studies will be made of:

1) mass-loss from massive stars
2) cluster dynamics
3) binarity and colliding stellar winds
4) ongoing and triggered star formation

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Bow Shocks from Runaway Stars

The Bow Shock Survey (BOSS), soon to be published, looks at IR, H-alpha and radio surveys for bowshocks from runaway stars

WISE IR images of bowshocks from;

alpha Camelopardalis and zeta Ophiuchi

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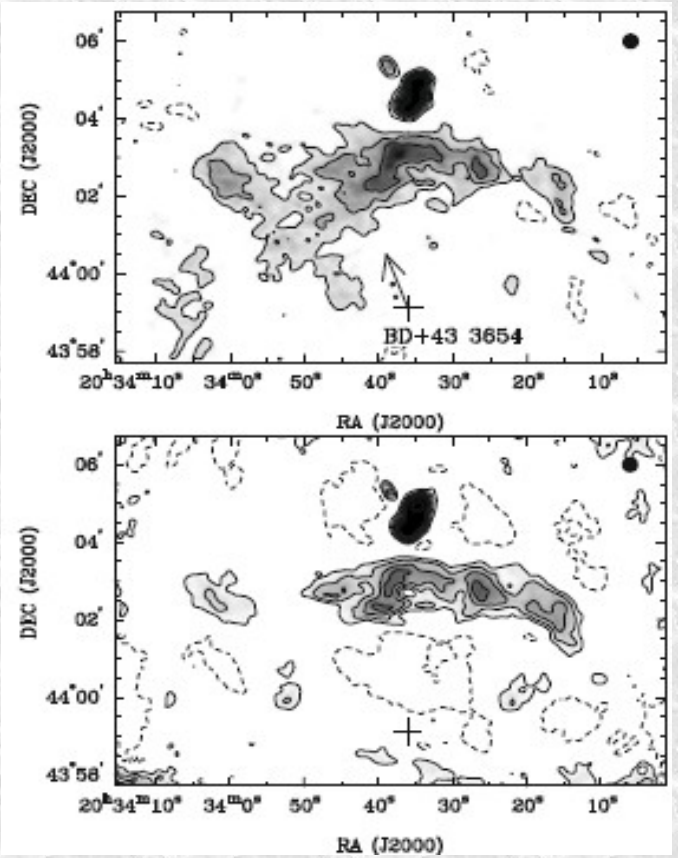
Bow Shocks from Runaway Stars

VLA observations of the bow shock of BD+43 3654, a type O4If star with a velocity of 66.2 ± 9.4 km s^{-1}, at 1.42 GHz (upper panel) and 4.86 GHz (lower panel) position of star is shown by +



Benaglia et al, 2010

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GMRT Observations

GMRT observations at 1.28 and 0.610 GHz of runaway BD+43 3654 are currently being analysed to determine details of the bow shock

Picture of sunset at GMRT by Ian Stevens

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References

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Dougherty, S.M., 2010, in Marti, J., Luque-Escamilla, P.L., Combi, J.A., eds, ASP Conf. Ser., 422, 166
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Any Questions?

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