H2 Outflows at $18^\circ < l < 30^\circ$; $-1.5^\circ < b < +1.5^\circ$

First results from the UWISH2 Survey

Georgios Ioannidis
Dirk Froebrich
• Scientific objectives
• Covered Area
• Outflows detection; Source Identification
• Distance calculation
• Sources of outflows
• Results so far
• Future work
SCIENTIFIC OBJECTIVES

• Characterise the dynamic component of star formation along a large fraction of the Galactic Plane in an unbiased manner.

• Determine the duration of the jet/outflow phase in YSO evolution (fraction of sources with jets/outflows).

• Determine the star formation efficiency along the Galactic Plane.

• How do jet/outflow properties (length, opening angle, power) relate to the source properties (mass, luminosity, age, accretion rates) and/or parental cloud (mass, structure) and/or mode of star formation (isolated/clusters)?
SE Arc FOR OUTFLOWS

IAU (1982) galactic coordinates; gnomonic projection

BLUE BOX - UWISH2 SURVEY - $7^\circ < l < 65^\circ$; $-1.5^\circ < b < +1.5^\circ$

CYAN BOX - SEARCHED AREA - $18^\circ < l < 30^\circ$; $-1.5^\circ < b < +1.5^\circ$

SEARCHED AREA ~ 20% OF UWISH2 SURVEY
DIFFERENCE IMAGES

H2
UWISH2

K
GPS

DIFFERENCE IMAGE
OUTFLOW SEARCH

H2 UWISH2 + K GPS + COLOUR IMAGES + DIFFERENCE

IN TOTAL 744 IMAGES COVERING 33 SQUARE DEGREES WITH 0.20″ / PIXEL
IMAGES HAVE BEEN SEARCHED IN A RANDOM ORDER
OUTFLOW SEARCH
OUTFLOW SEARCH
OUTFLOW SEARCH
OUTFLOW SEARCH
OUTFLOWS ON 100um DUST MAP

IAU (1950) galactic coordinates; gnomic projection

125 OUTFLOWS
OUTFLOWS ON GPS AV MAP

IAU (1950) galactic coordinates; gnomonic projection

125 OUTFLOWS
SOURCES OF OUTFLOWS

GLIMPSE SURVEY
IRAS
AKARI
BGPS
RED EXCESS STARS - VARIABILITY
DISTANCE CALCULATION
Measure the number of foreground stars and compare with Besancon Galaxy model (Robin et al. 2003).
RESULTS SO FAR

LONGITUDE - DISTANCE PLOT

Distance (Kpc)

0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0

Distance (Kpc)

0 1 2 3 4 5 6 7 8

GC
RESULTS SO FAR

LATITUDE HISTOGRAM

N (Number of outflows)

Latitude (pc)
RESULTS SO FAR

OUTFLOWS PER SQUARE Kpc

N (Number of outflows/square Kpc)

Distance (Kpc)

1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

120 110 100 90 80 70 60 50 40 30 20 10
RESULTS SO FAR

OUTFLOWS LUMINOSITY HISTOGRAM (Limit 0.5)

N (Number of outflows) vs. LUMINOSITY/SOLAR LUMINOSITY
RESULTS SO FAR

LONGITUDE - DISTANCE PLOT (colour coded)
RESULTS SO FAR

LUMINOSITY - DISTANCE ABOVE/BELOW GP PLOT

LOG LUMINOSITY/SOLAR LUMINOSITY

10^3 10^2 10^1

10^3 10^2 10^1

Z Distance (pc)

100 50 0 -50 100 150
RESULTS SO FAR

LUMINOSITY - DISTANCE PLOT

Distance (Kpc) vs. Luminosity/Solar Luminosity
RESULTS SO FAR

LUMINOSITY PER SQUARE Kpc

Distance (Kpc)

N (LUMINOSITY/SQUARE Kpc)
FUTURE WORK

• Jets morphology
• Position angles and length of jets
• Source properties (mass, luminosity, age, accretion rates)
• How jet properties relate to source properties?
• Cloud properties (mass, structure)
• Associate outflows with cloud cores – what percentage of clouds show active forming areas
• Fraction of sources with jets/outflows - duration of the jet/outflow phase in YSO evolution
• Is the star formation isolated or clustered?
• Determine mass accretion rate – Star formation rate
FUTURE WORK

EXTEND THIS WORK TO

ALL UWISH2 SURVEY