New Brown Dwarfs in Upper Scorpius

Brown Dwarfs in Upper Scorpius: New Results From 3 Surveys

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New Brown Dwarfs in Upper Scorpius

"The determination of the stellar Initial Mass Function (IMF) is one of the Holy Grails of astrophysics" (G. Chabrier, 2005)

Low mass end of the IMF needs to be determined.

Test competing theoretical concepts.

Is there a universal IMF?

Are there different modes of formation?

Need more brown dwarfs!

New Brown Dwarfs in Upper Scorpius

UKIRT Hawaii

UKIRT Infrared Deep Sky Survey (UKIDSS)
Galactic Cluster Survey (GCS)

New Brown Dwarfs in Upper Scorpius

Welcome to Upper Scorpius

OB association

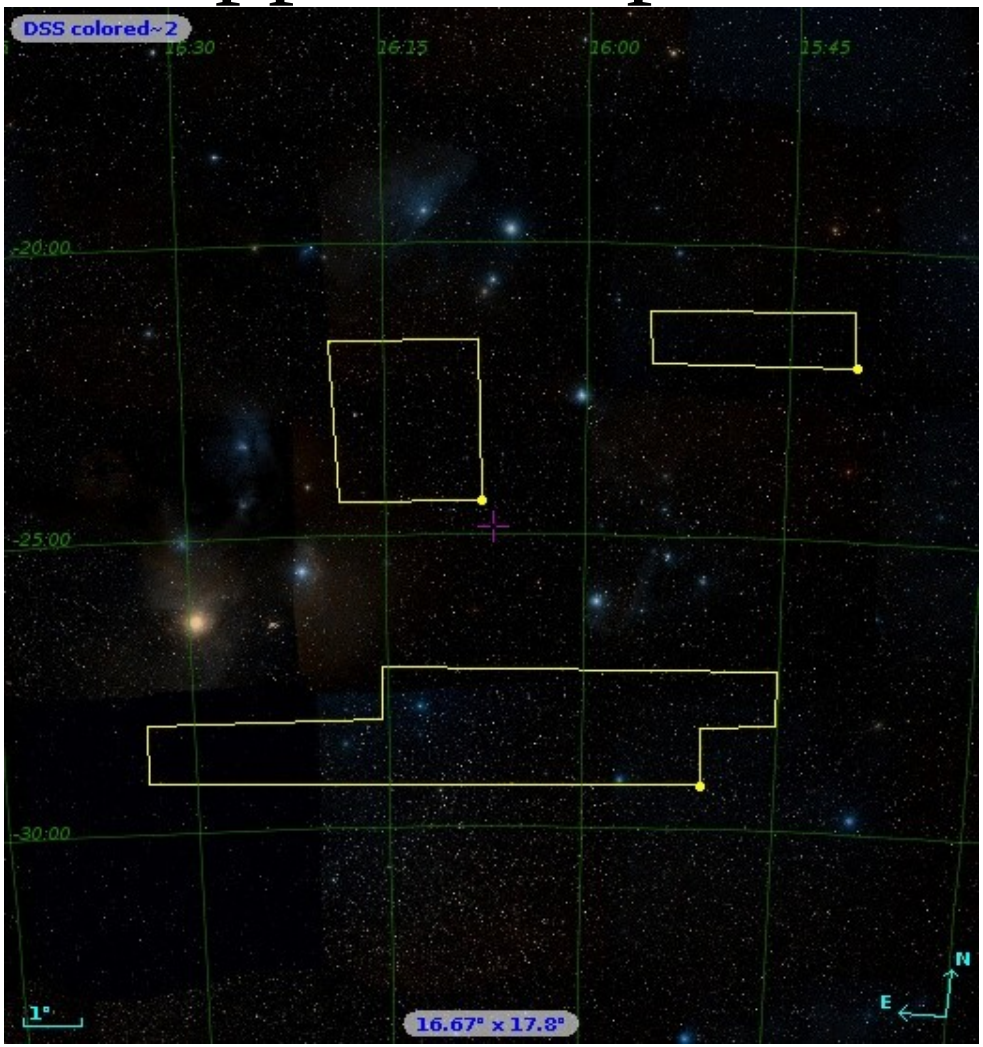
145pc distant

5Myr old

Spread over 250 deg^2

28 deg^2 covered by UKIDSS

12 deg^2 in South



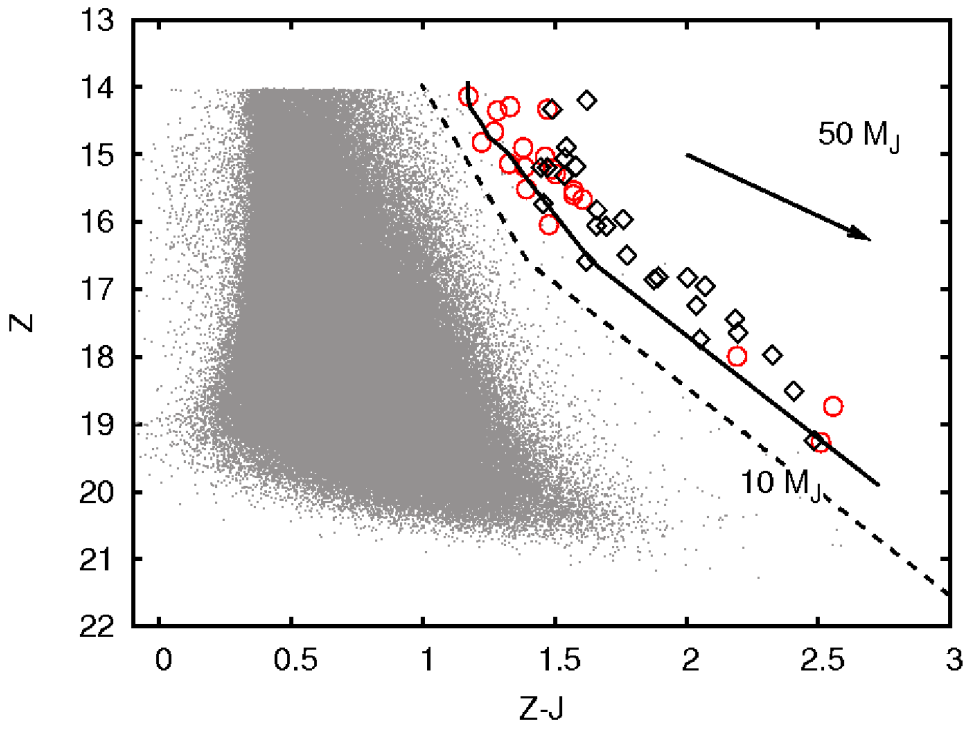
New Brown Dwarfs in Upper Scorpius

Colour Magnitude Diagram

282,938 objects mostly on main sequence.

Brown dwarfs stand apart from main sequence in (Z-J, Z).

Not all combinations are so clear.



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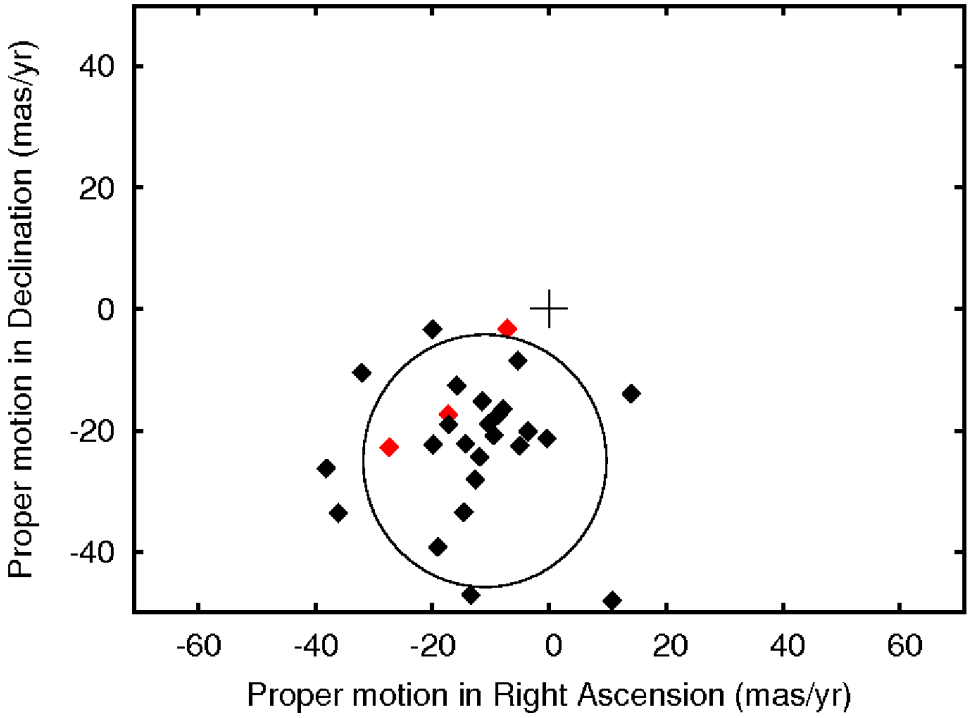
Vector Point Diagram

27 photometrically selected objects.

UKIDSS GCS compared with 2MASS.

Sample centered on (-11,-25).



New Brown Dwarfs in Upper Scorpius

Ratios of Stars to Brown Dwarfs

(0.09–1.0/0.03–0.08 solar masses)

North:	3.9 +/- 2.0
South:	3.5 +/- 1.4
Overall:	3.8 +/- 1.1

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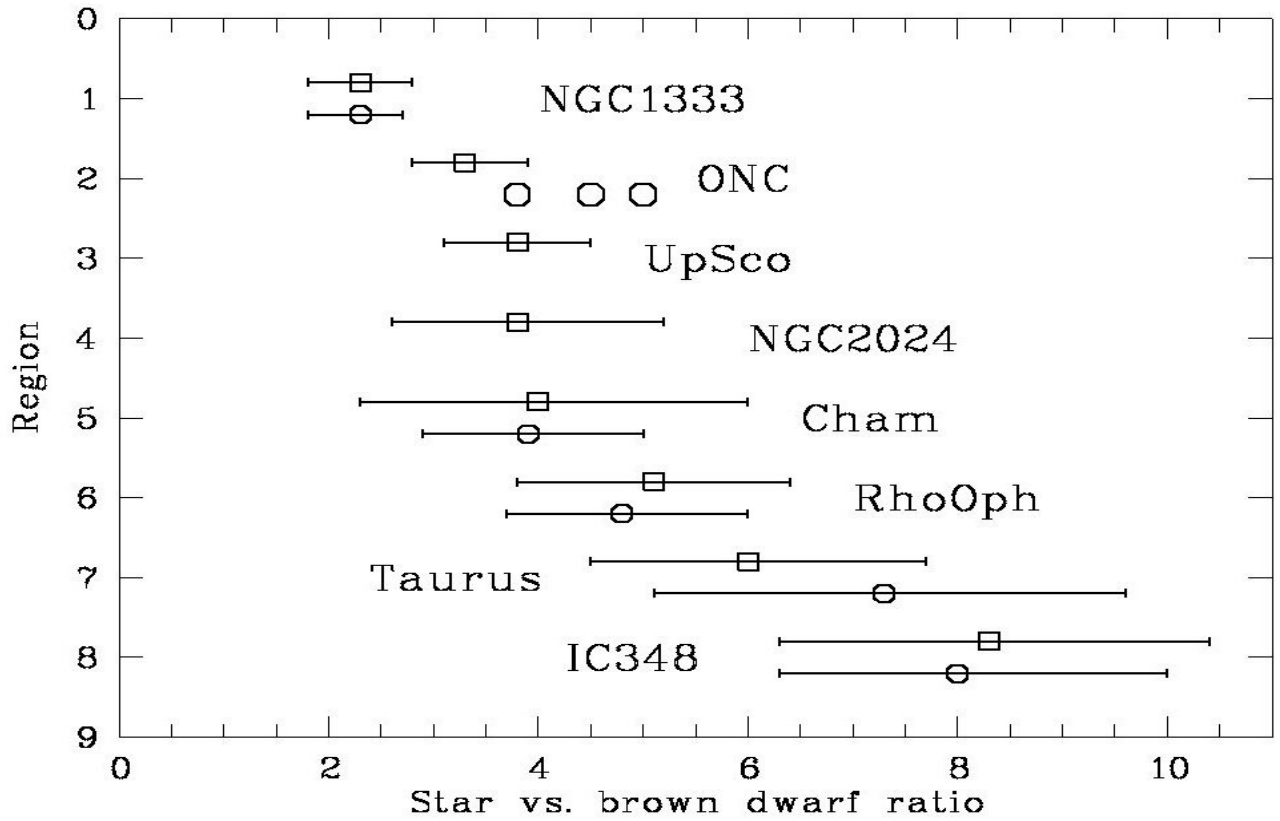
Ratios of Stars to Brown Dwarfs



Scholz et al (2011)

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Conclusion

The presence of OB stars favours the formation of brown dwarfs.*

*Terms and conditions apply. Brown dwarf numbers may go down as well as up.

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Brown Dwarf Disks

Need unbiased samples to determine disk fraction.

How long do brown dwarf disks last?

Do circumsubstellar and circumstellar disks differ?

Planet formation around brown dwarfs.

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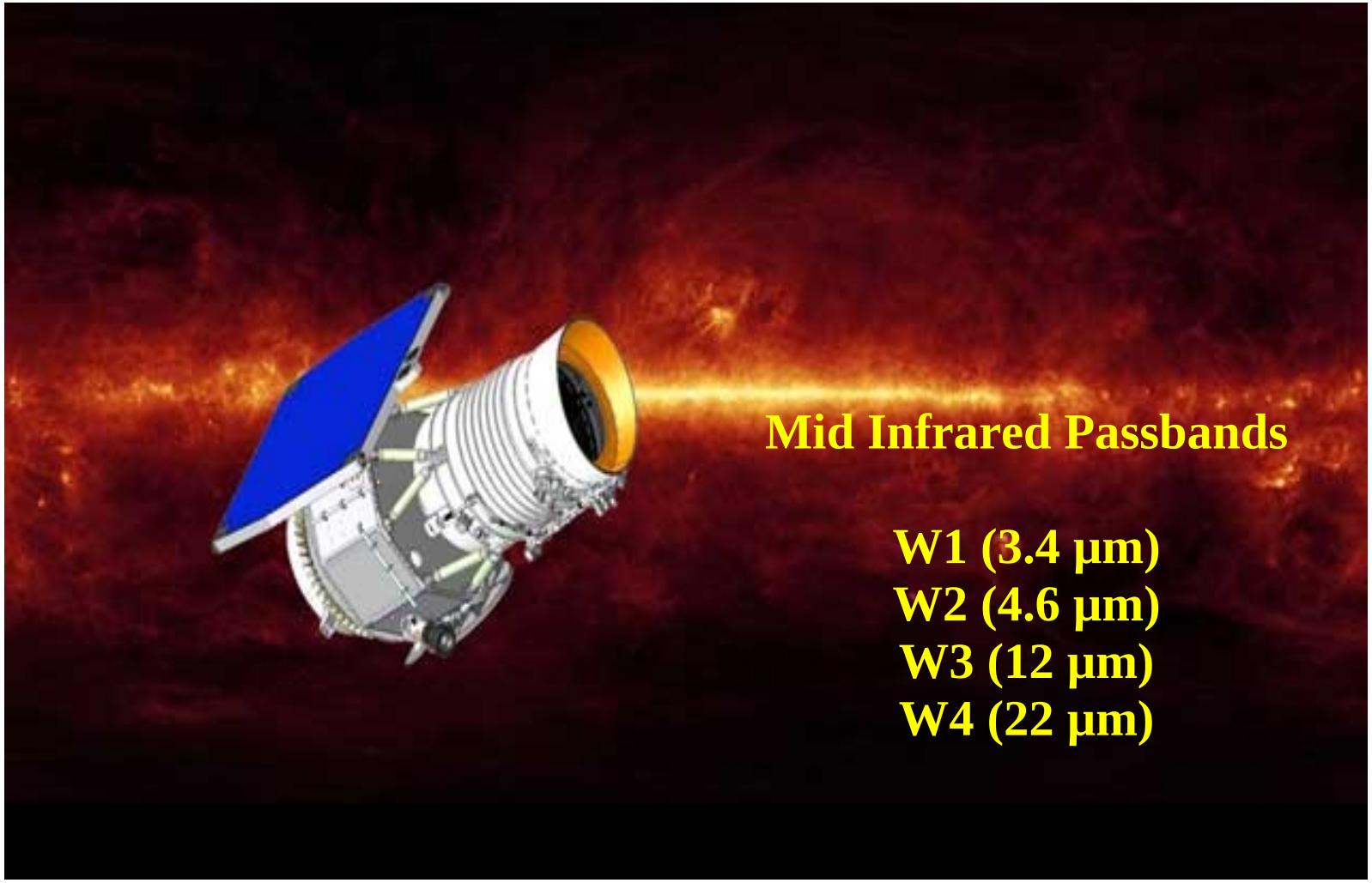
A word to the WISE:
Brown dwarf disks are best searched for using mid infrared.



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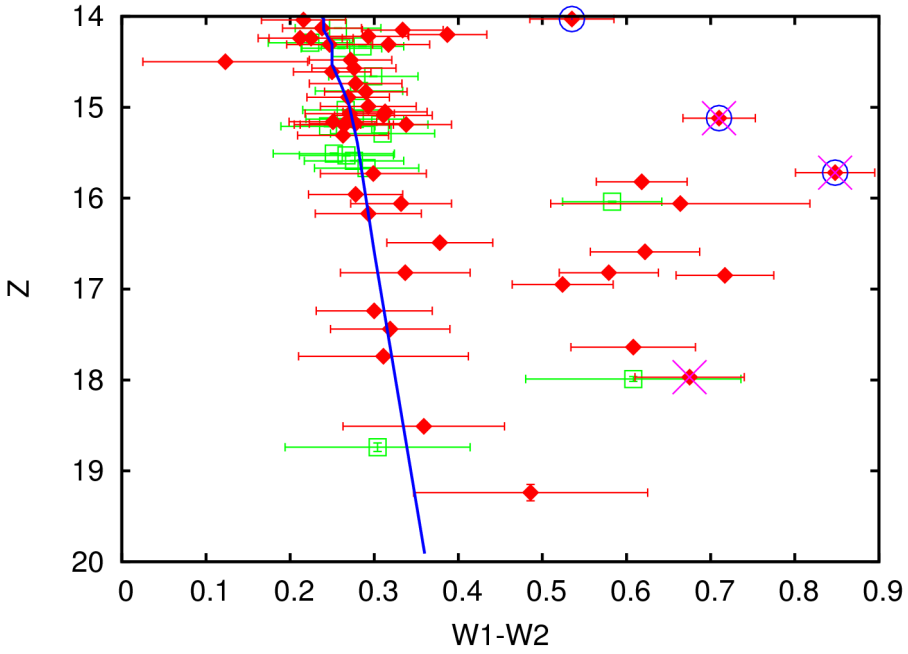
Colour Magnitude Diagram

Some objects close to isochrone. Some show clear excess in W1-W2.

Objects with evidence of a disk have W1-W2 excess.



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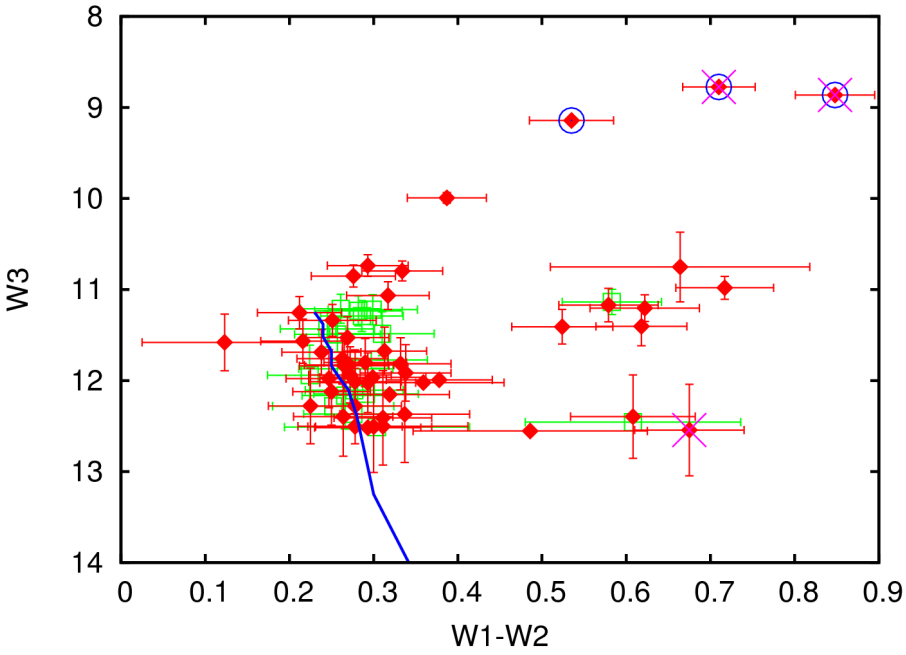
Colour Magnitude Diagram

Objects bright in W4 also bright in W3.

One object with only slight W1-W2 excess is bright in W3.

It must have a disk. Perhaps a "transition" disk?



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Brown Dwarf Disk Fraction

Previously: 0.37 +/-0.09
(Scholz et al 2007 with 35 objects)

Now:

North:	0.25 +/- 0.13
South:	0.11 +/- 0.14
>50M_J:	0.10 +/- 0.12
<50M_J:	0.27 +/- 0.13
Overall:	**0.21 +/- 0.10**

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Brown Dwarf Disk Fraction

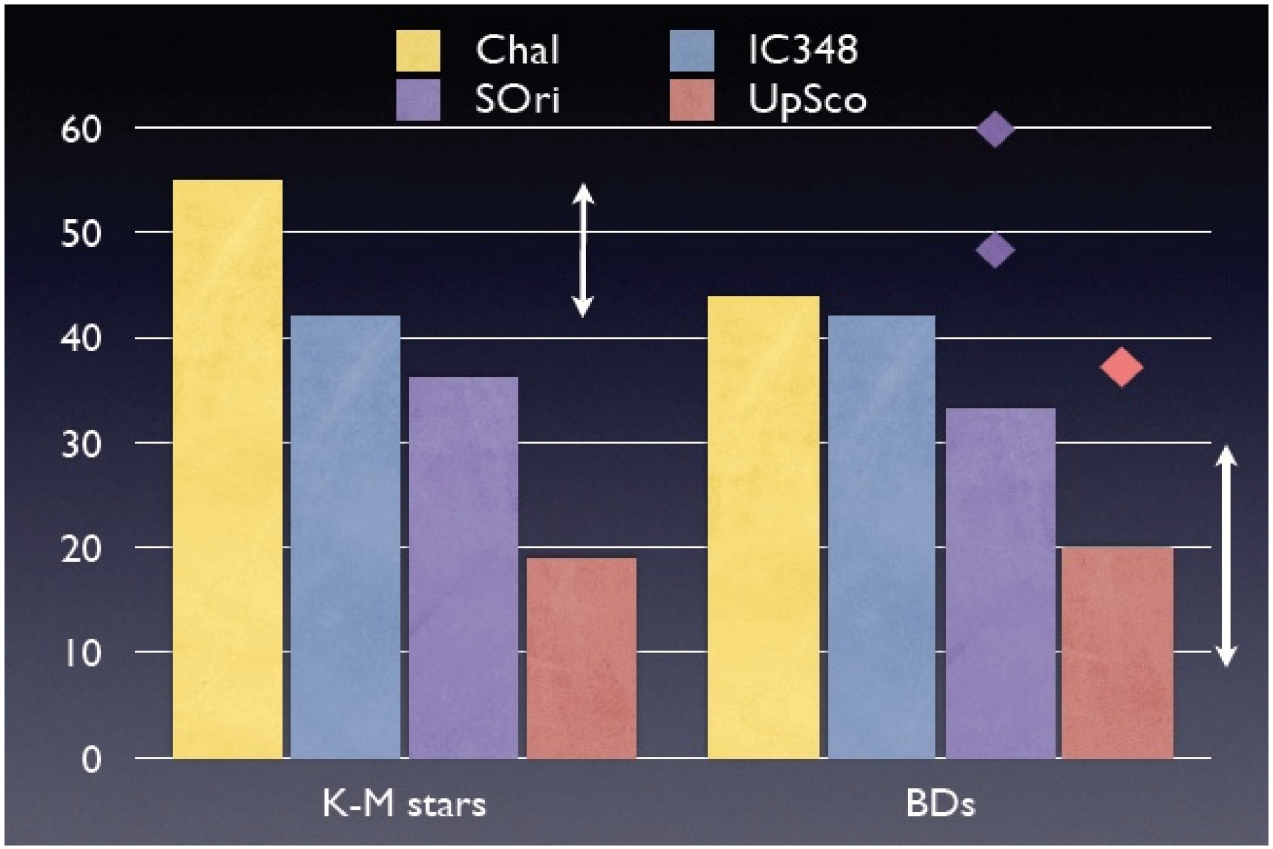

Figure courtesy of: Aleks Scholz

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Conclusion

The lifetimes of disks around brown dwarfs and K and M stars are independent of the mass of the central object.