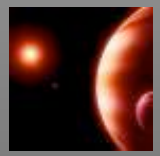
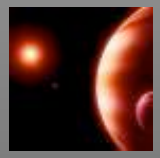
The Search for Planets at the End of the Main Sequence

Jacob Bean



Summary

- Initiated a comprehensive search for planets around the lowest-mass stars
- Current survey includes 36 M2 – M9 stars, mostly below 0.2 M_{sun}, median = 0.15 M_{sun}
- NIR radial velocities with CRIRES at the VLT
- Current program is being run as an ESO “Large Program” -- 33 nights over two years (2009 – 2010)
- New gas absorption cell for calibration
- Ultimate goal of 5 m s^{-1} per visit precision
- Aim for the detection of Neptune-mass planets in short period orbits; Saturn-mass in intermediate and longer period orbits
- Expand the survey in 2011+ to include ~100 stars with M < 0.2 M_{sun}



Motivation

- Explore the correlation between planet formation efficiency and stellar mass

  Are gas giants rare around low-mass stars?

- Improve the galactic planet census

  These stars are the most numerous stars in the Galaxy, but yet we have very little information on the nature of their planetary systems

- Identify new planets for follow-up study

  Low-mass stars are the short-cut to finding transiting habitable planets

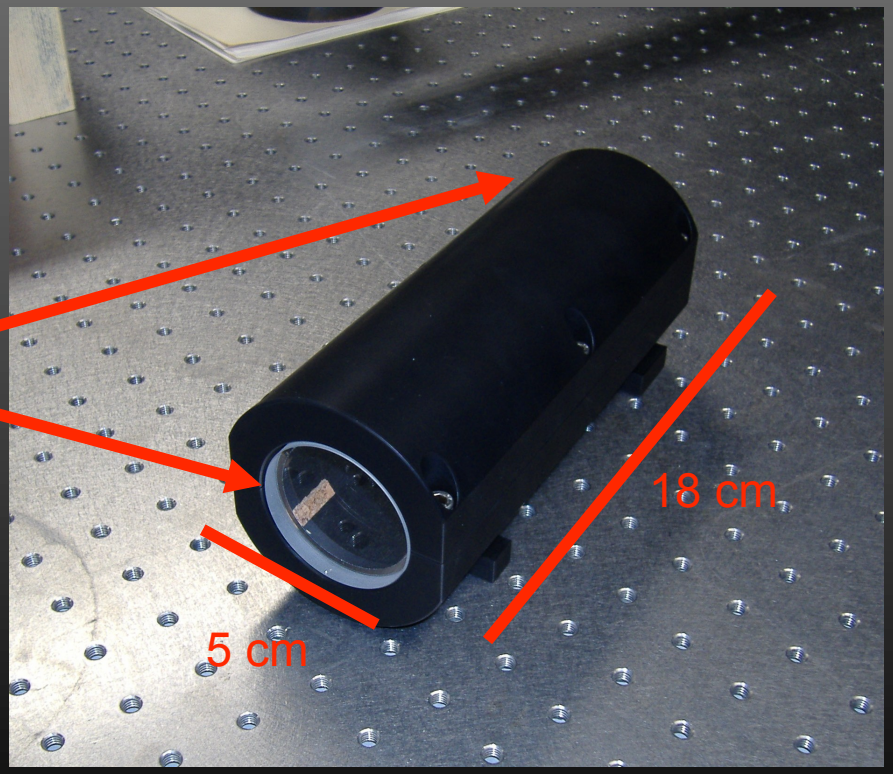
- Provide a foundation for future high-precision NIR radial velocity work

  What are the important things to consider when designing the next generation of radial velocity instruments?

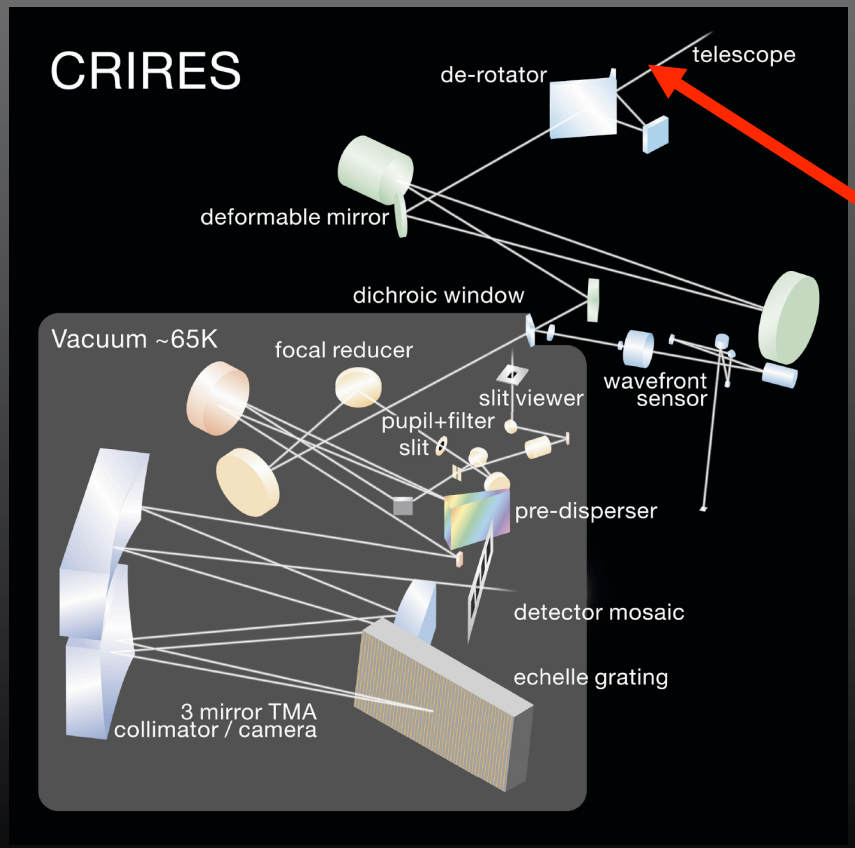
Method: A new gas cell for the NIR

filled with 50 mb ammonia (NH_3)

wedged windows to eliminate fringing



Method: CRIRES at the VLT



gas cell goes here
to enable calibration
of each observation

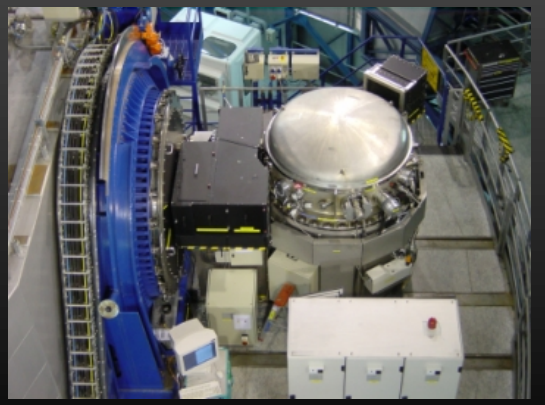
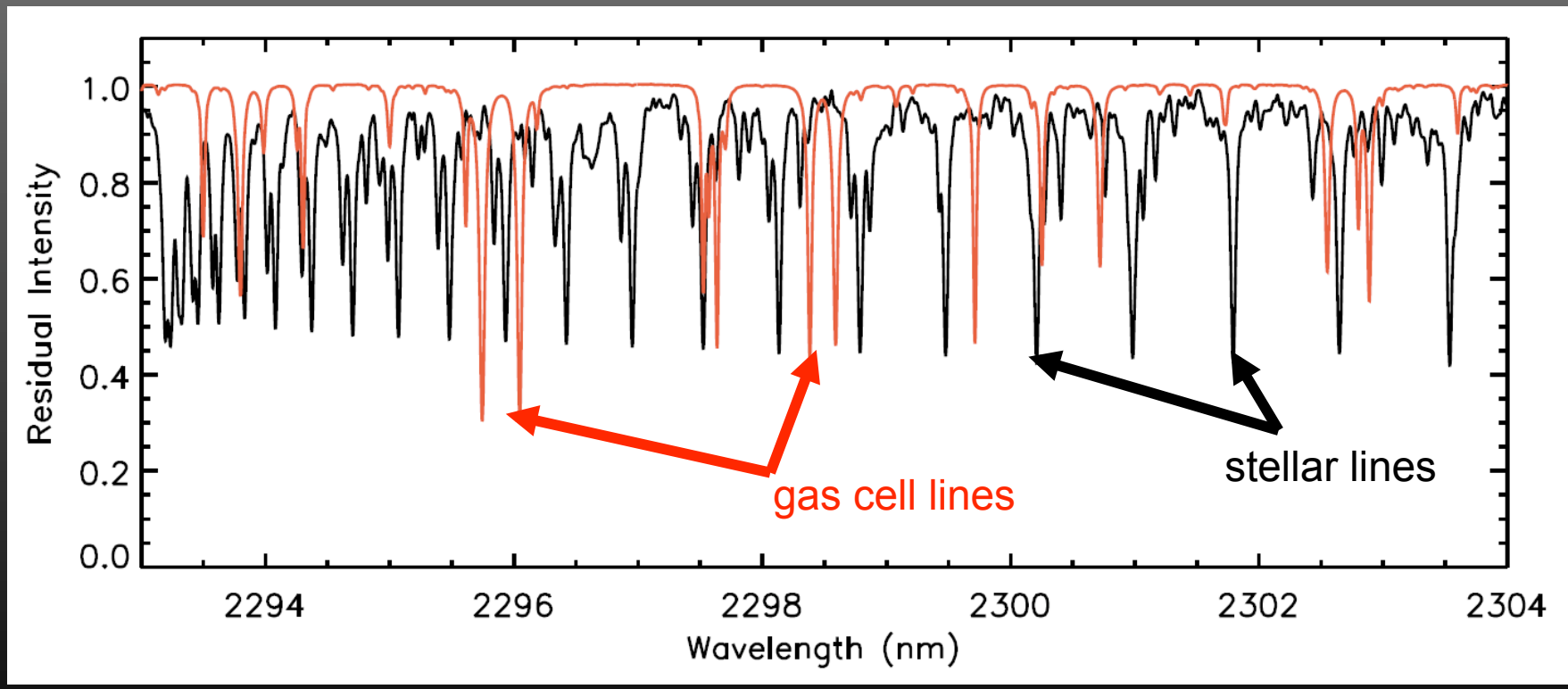
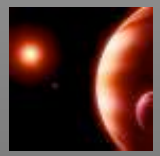


Image credits: ESO

Method: Gas cell lines overlap for in situ calibration





Demonstration

High-precision radial velocities of a V=17.5 M8 star in 20 minutes