Tracing the HI content in distant reddened QSOs with ASKAP

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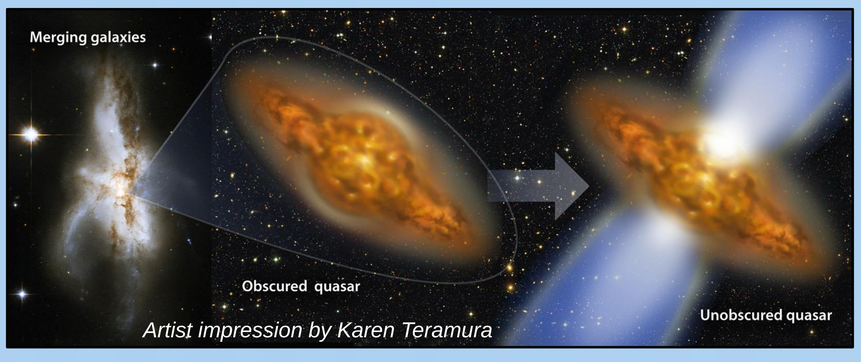
1. REDDENED QUASARS – WHY STUDY THEM?

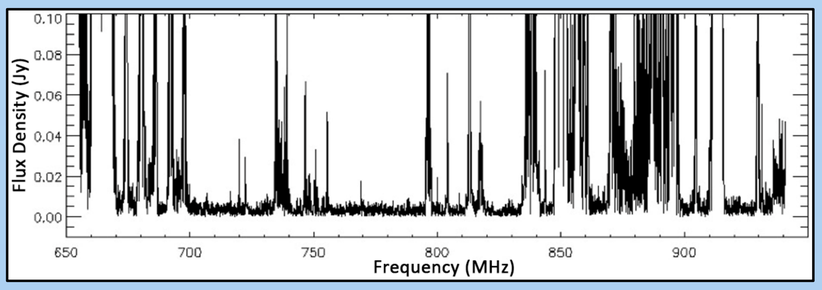
Reddened quasars are AGN which are obscured and fed by gas and dust. This is a short transitional stage (~ few million years) in galaxy evolution (Hopkins et al. 2006), and hence these objects are rare. **What is going on in the obscured nucleus during this phase?**

We used **HI 21-cm absorption** to detect the cold atomic gas in the obscuring medium of reddened quasars and study the gas kinematics. This will potentially help us understand **how these objects transition out of the obscured phase**.



2. ASKAP – BEATING THE RFI PROBLEM

Radio Frequency Interference (RFI), signals from mobile phones, satellites, aviation radar, wireless devices, etc., contaminate data.



RFI-affected spectrum from the Green Bank Telescope (650 – 950 MHz).

The **Australian SKA Pathfinder (ASKAP)** in Western Australia benefits from a very **radio-quiet** environment.

ASKAP antenna at the Murchison Radio-astronomy Observatory. Image: CSIRO.

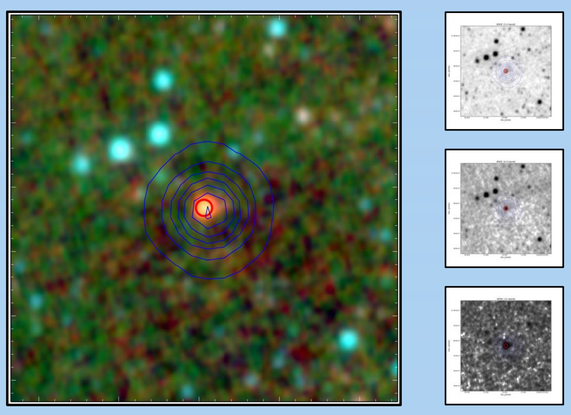
ASKAP uses **Phased Array Feeds (PAFs)** to produce a **30 square degree field of view**, and has an **instantaneous bandwidth of 304 MHz** between 700 - 1800 MHz.

3. A STUDY OF ATOMIC GAS IN OBSCURED QUASARS

The **FLASH** (**First Large Absorption Survey in HI**) team undertook pilot HI absorption surveys for commissioning. One **sample was of reddened quasars** which was observed with **ASKAP-BETA** (prototype six-antenna array with early-gen PAFs).

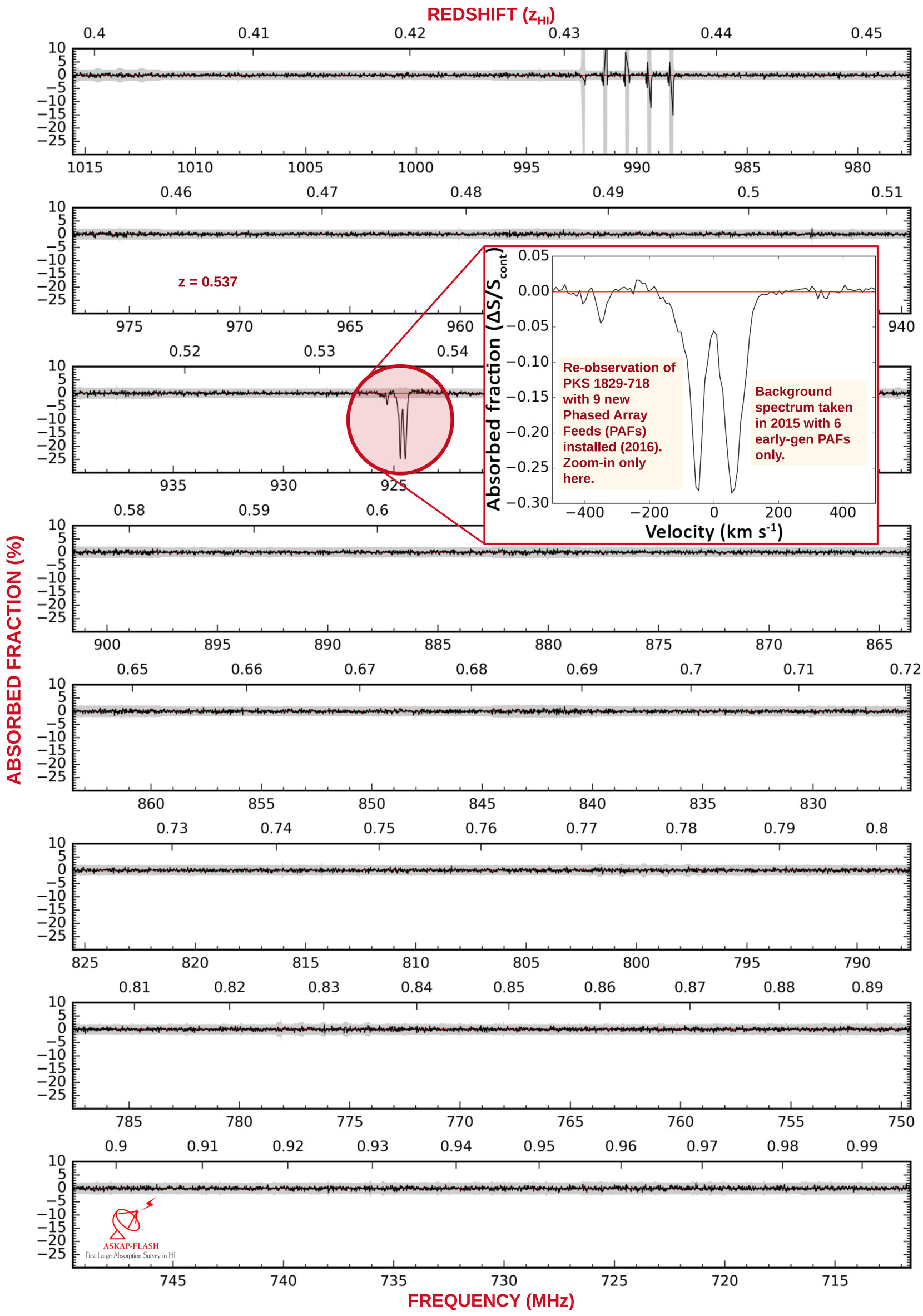
From the 1-Jy Kuhr sample, we selected **38 QSOs** that were either:

- **optically faint** (R-band > 20 mag),
- **reddened in their mid-infrared colours** from the Wide-field Infrared Survey Explorer (WISE) survey.



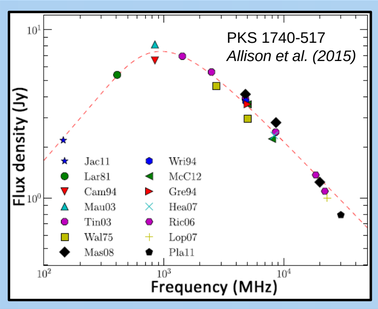
WISE 3-colour image (3.4, 4.6, 12 μm) of 3C 275 with SUMSS radio contours. Images made on my website: ***www.physics.usyd.edu.au/askap_targets***

HI absorption detection in 300 MHz spectrum of PKS 1829-718 by ASKAP (2015)



4. DETECTIONS AND ANALYSIS

Two new detections were achieved in our sample: **PKS 1740-157** (Allison et al. 2015) and **PKS 1829-718** (above). **Another known detection** (**PKS 0500+19**) at lower optical depths was made by Carilli et al. (1998). All three detections are associated with **Giga-Hertz Peaked Spectrum (GPS) sources** (right), which are thought to be young or recently re-triggered AGN. Proposals for follow-up at other wavelengths and modelling of the potential AGN dynamics is underway.



References and Acknowledgements

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