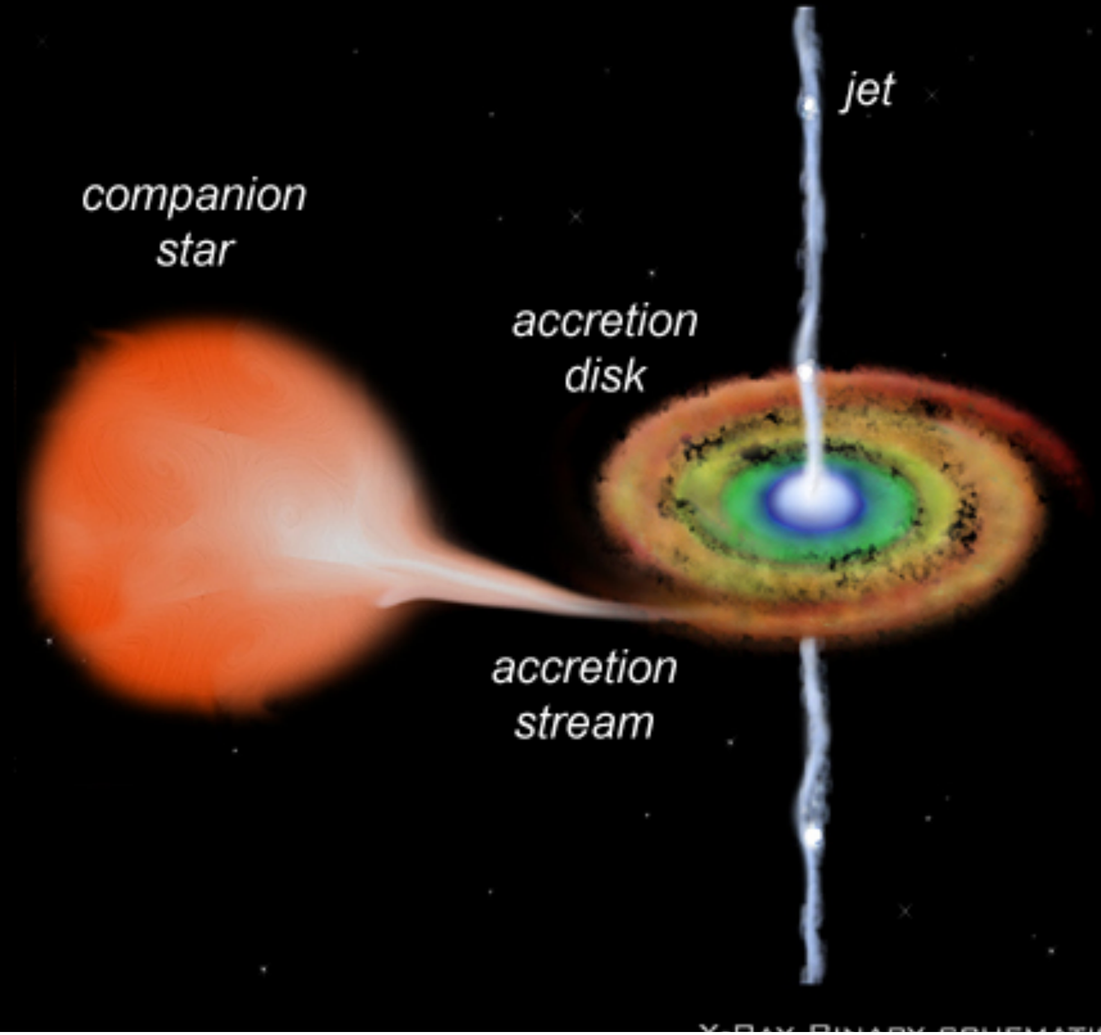
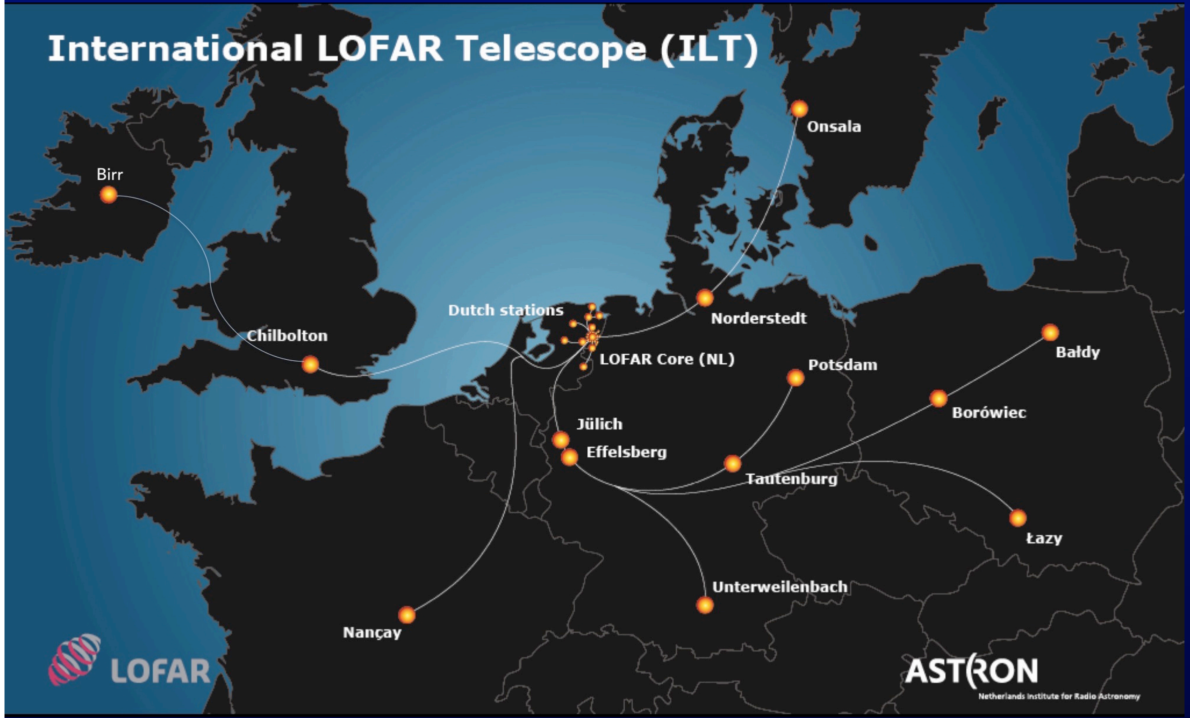
4th Year Research Projects, 2019/2020



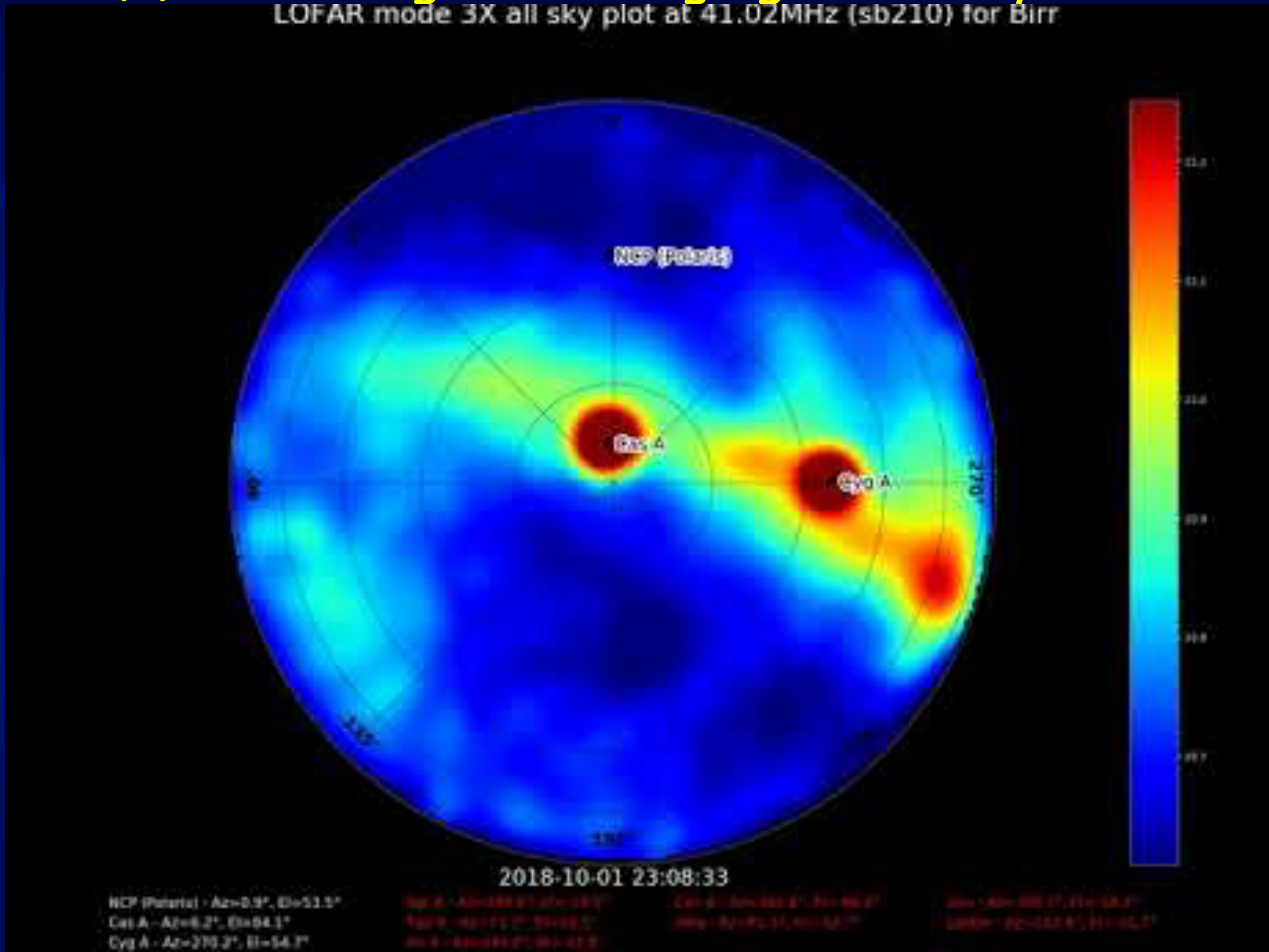
Prof Paul Callanan

Project 1 and 2

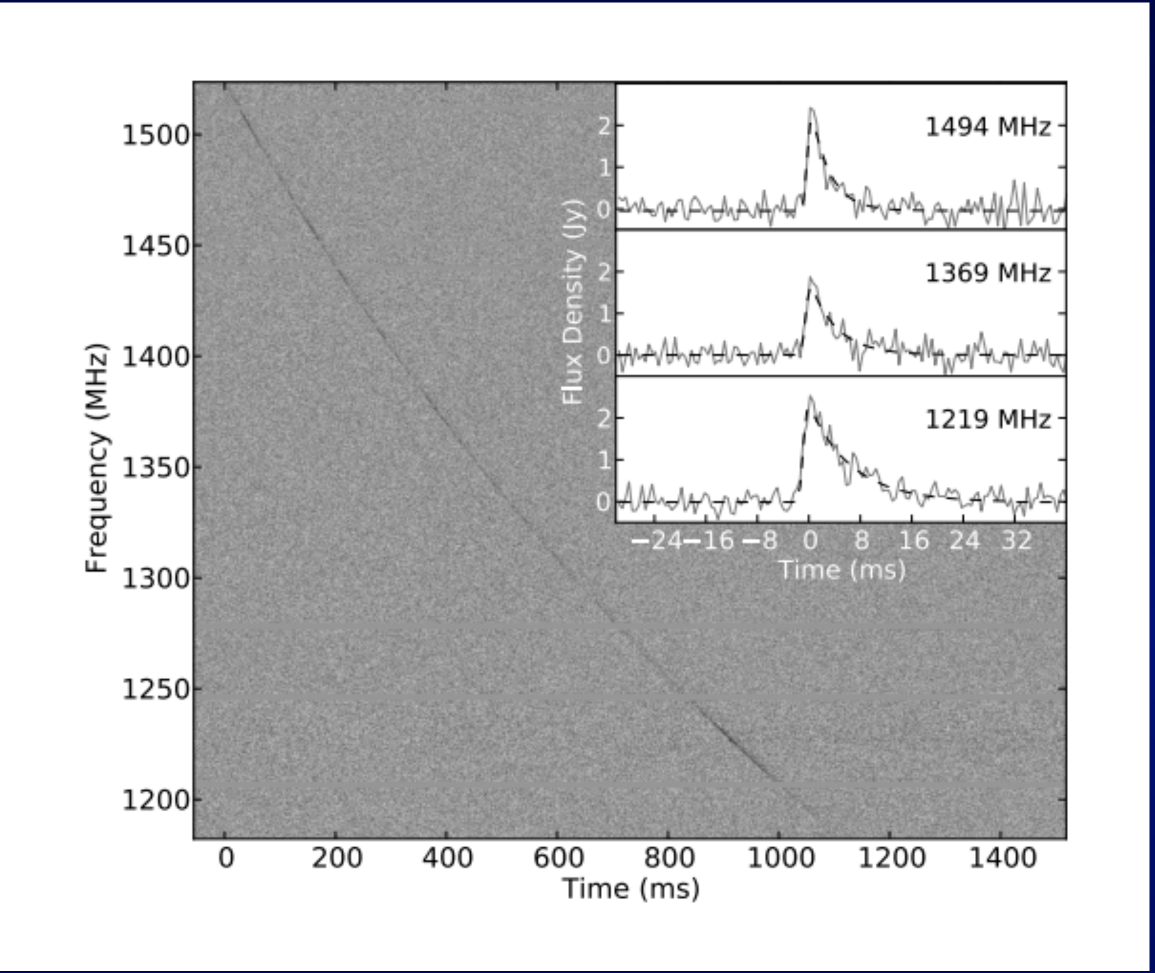
I-LOFAR
- low frequency radio telescope in Birr



Applications: (a) observing the changing radio sky



Here we need to investigate making higher resolution images using the HBA…

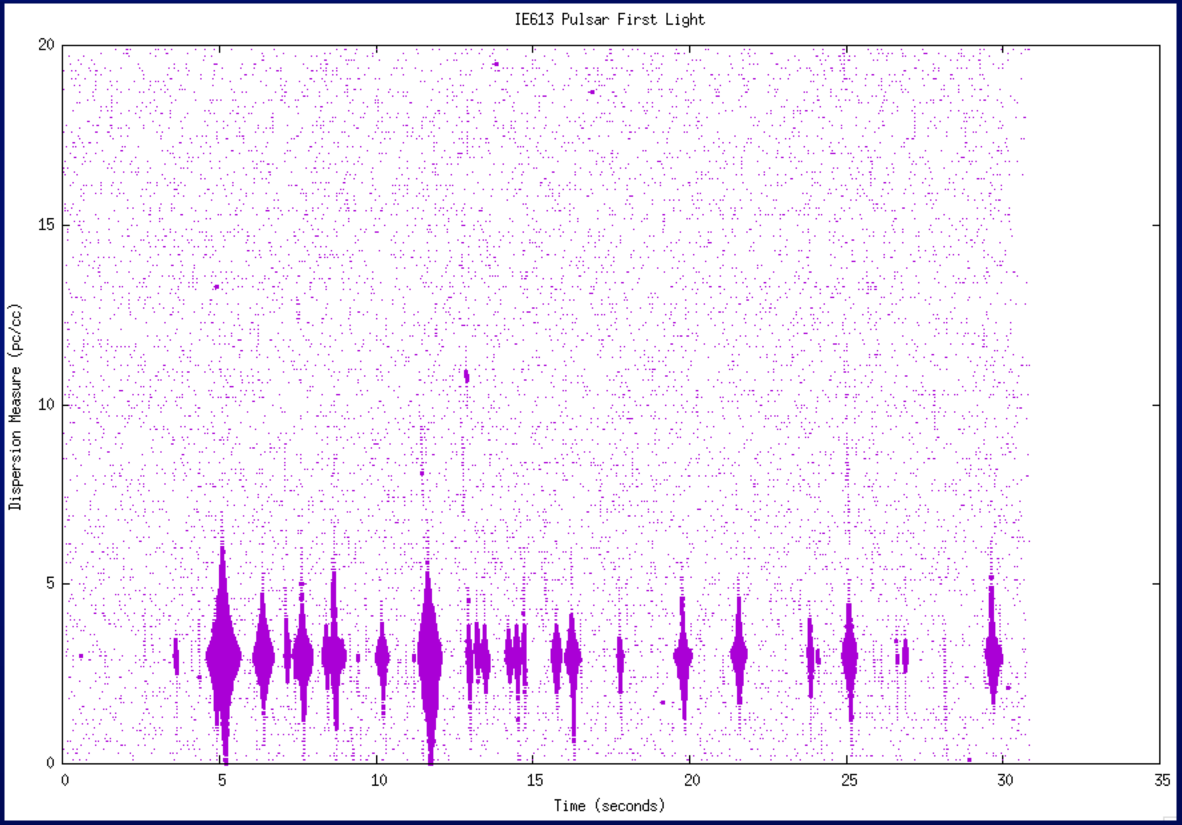


An important application of this is the study of "Fast Radio Bursts".

The "REALTA" system (next slide) can process large amounts of all sky data, in real time.

This project to use the HBA antennae on I-LOFAR to produce high time resolution all sky images in collabration with Dr Griffin Foster, Oxford University.

(b) "REALTA" is the I-LOFAR "REALtime Transient Acquisition" cluster (4xserver, 0.3 PB, 4x16Tflops GPUs, UCC funded) – ideal for pulsar studies

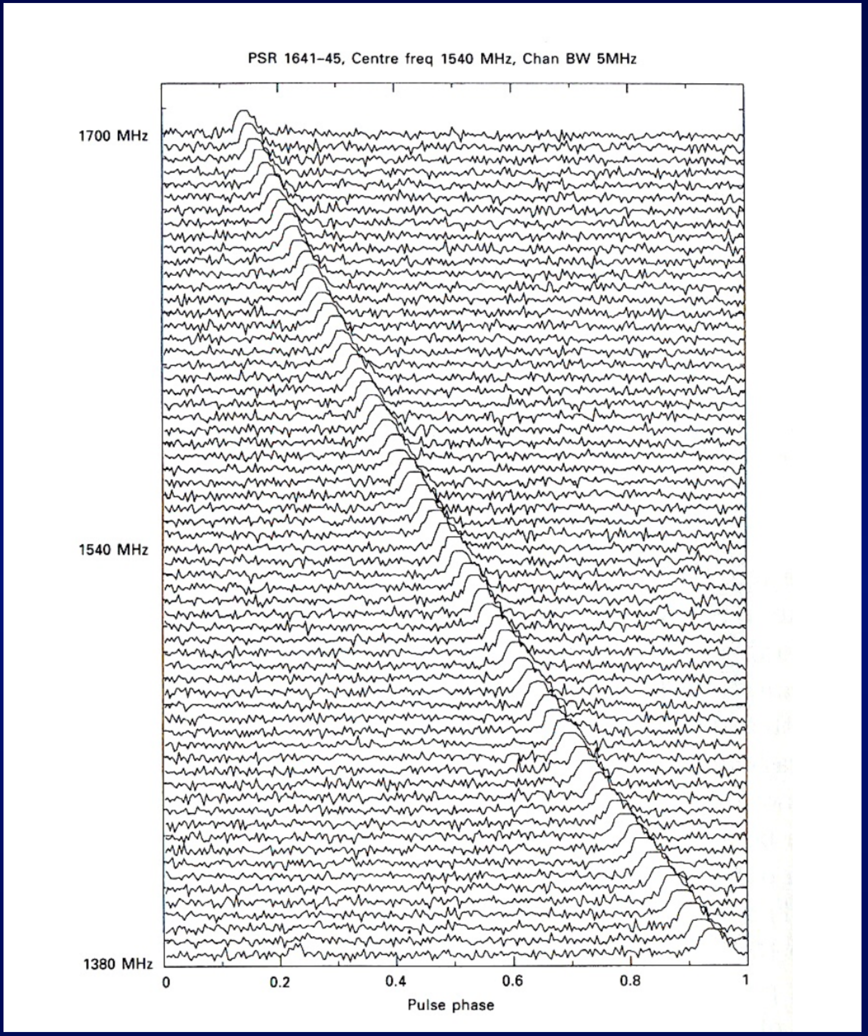


Pulsar B0950+08 from I-LOFAR

Project – obtain new data with I-LOFAR and REALTA to study pulsar

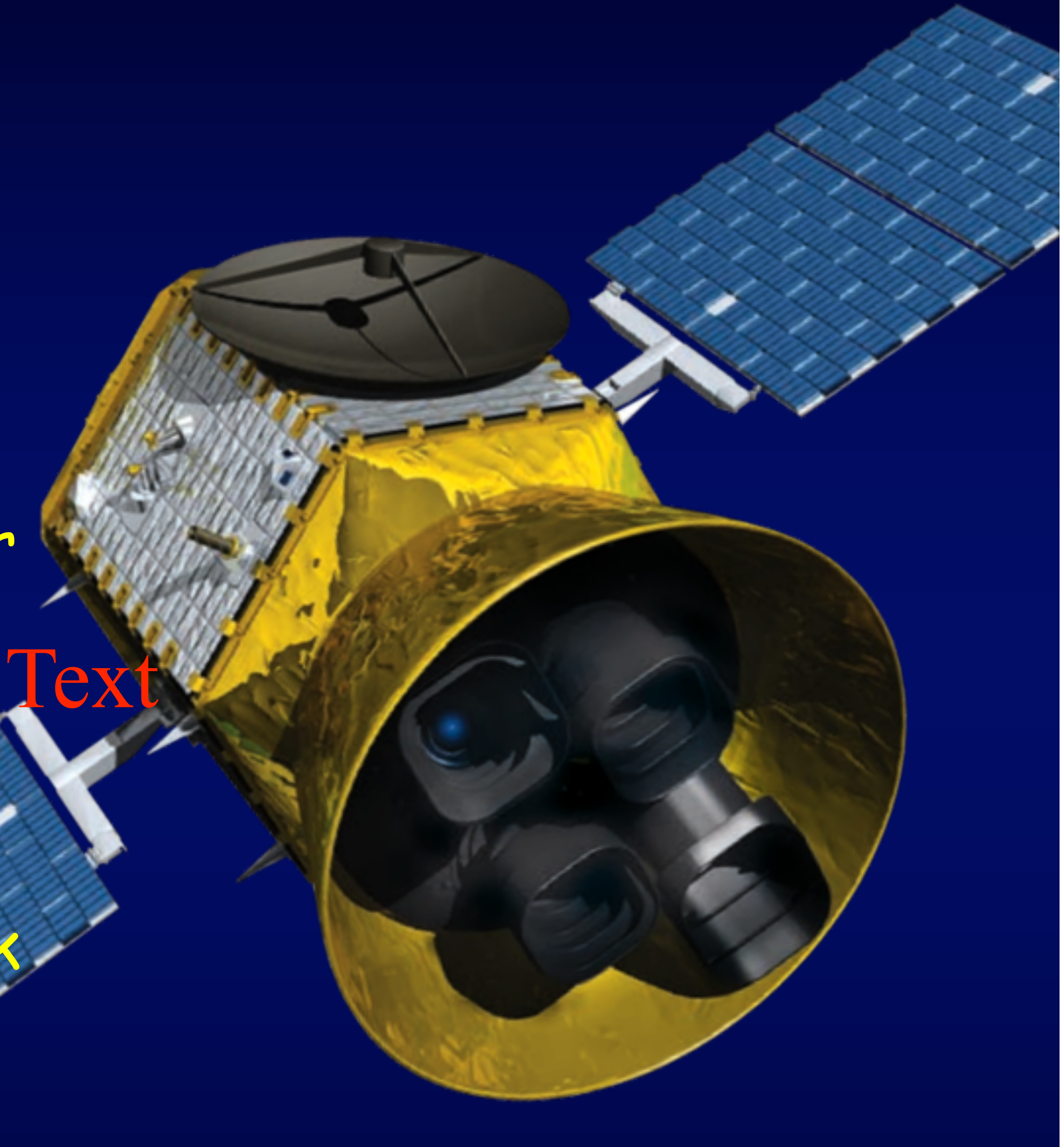
- Timing
- De-dispersion
- Giant pulses
- Glitches

In collabration with Dr Evan Keane, Manchester Univeristy/SKA



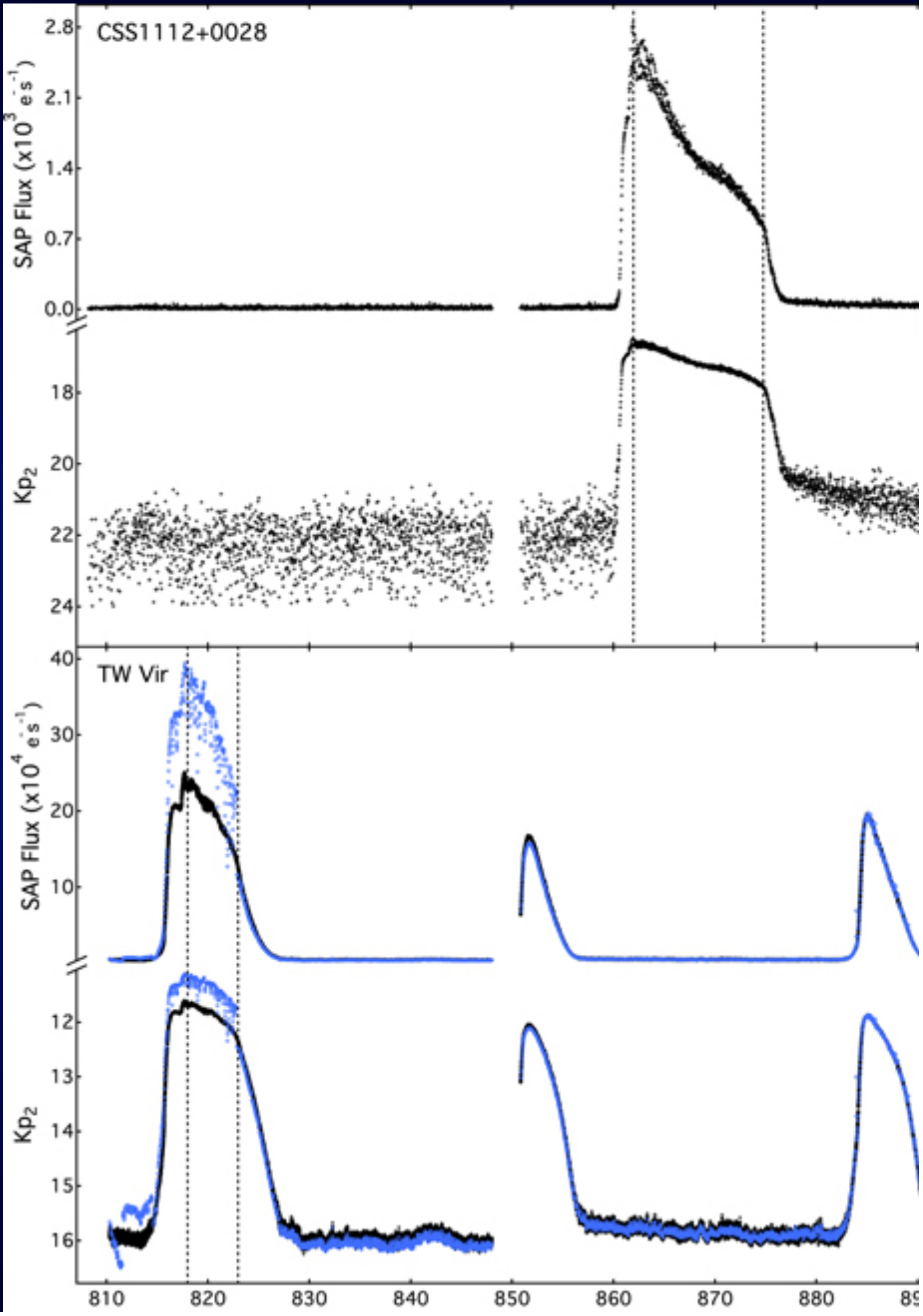
Project 3

NASA's TESS mission continues to monitor large parts of the sky for extrasolar planets and other variable objects.



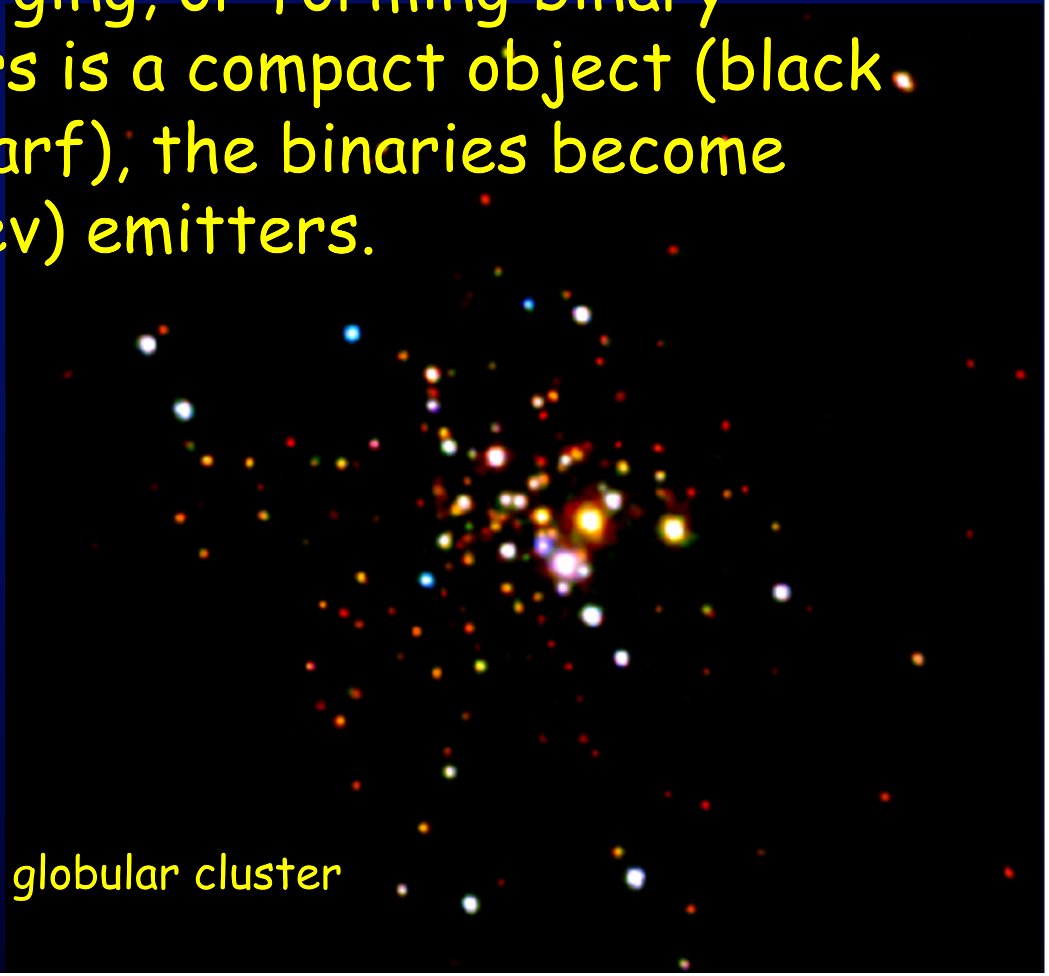
Many of these objects are accreting white dwarfs (CVs), neutron stars or black holes (X-ray Binaries). Because of the early stages of this mission, these data have not been studied, so far…

It it important to measure the light curves of each of these objects, to determine how the accretion disk interacts with the accreting star. The student will be expected to analyse the light curves of these CVs and X-ray binaries, attempt to classify these systems, model the lightcurves and organise follow up observations if necessary.

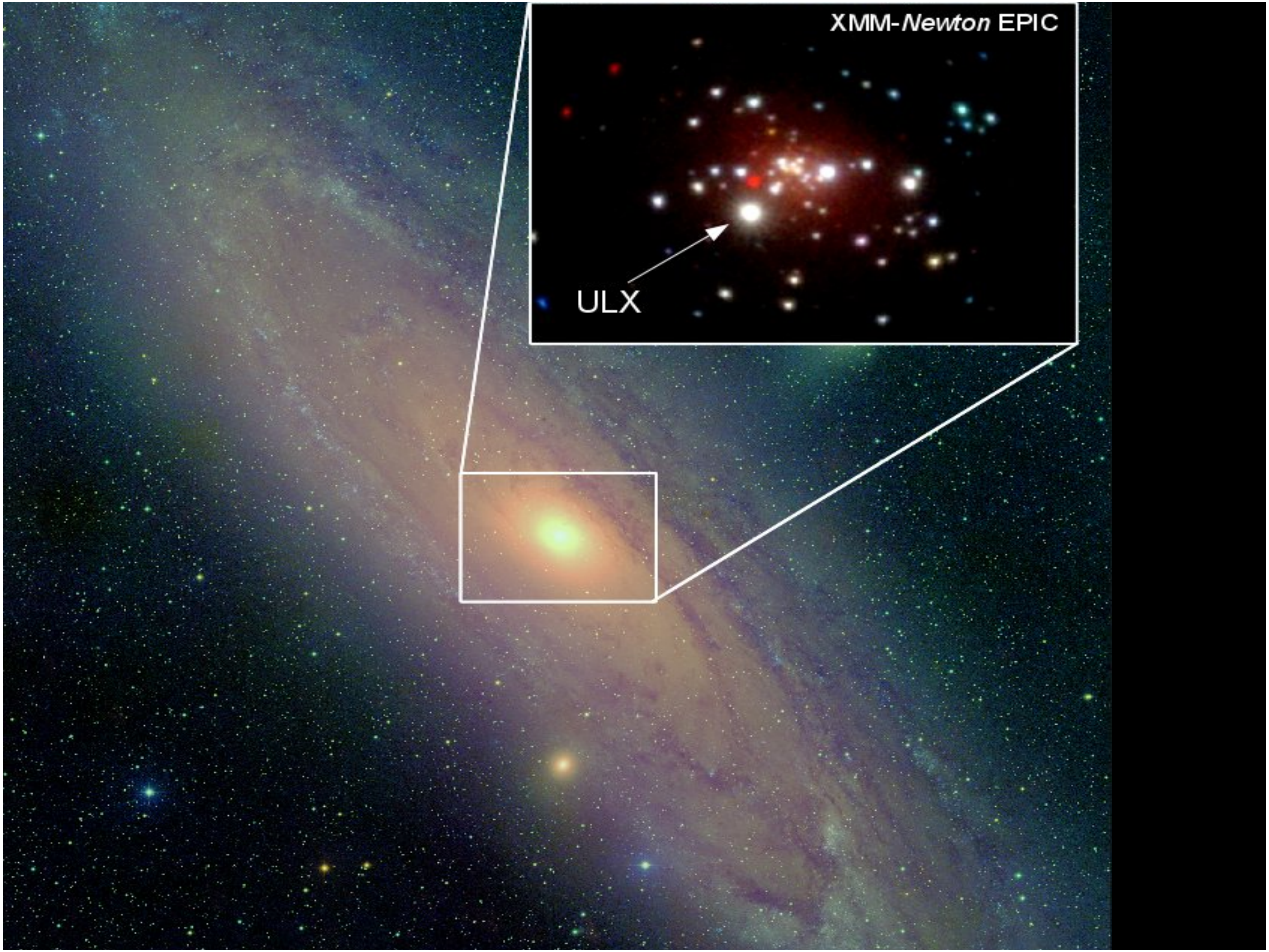


Project 4

In the cores of dense globular clusters and galaxies, the number of stars per unit volume is such that they scatter off each other, sometimes merging, or forming binary systems. When one of the stars is a compact object (black hole, neutron star or white dwarf), the binaries become visible as bright X-ray (1-10 kev) emitters.



X-ray image (0.5-10 keV) of a globular cluster


XMM-Newton EPIC
ULX

The student will:

- Analyze Chandra X-ray images of globular clusters (e.g. Omega Cen, M22 and 47 Tuc), and perform the astrometry required to localize the positions to within < 0.5''.
- Relate these measurements to HST observations of the same field, identifying optical counterparts to the X-ray sources on the basis of their spectral energy distribution and variability.

The HST observations are required because of the very crowded nature of these fields.

These measurements will allow us to identify new white dwarf, neutron star systems, and address the existence of black holes in globular clusters.

For more details on any of these projects, please contact Paul Callanan via paulc@ucc.ie, or call by my office (104C).