Dundee Astronomical Society Meeting Minutes 2019/2020 Season

24th January 2020 at the Mills Observatory

Committee Present

June Gilchrist	Chair
David Paterson	Secretary
Jim Barber	Director of Observations
Graham Young	Librarian
Tony Hayes	Website Developer
Phil Rourke	Minutes Secretary
Ken Kennedy	
Andy Heenan	

Apologies

Ed Fraser, Graham McAteer

June opened the meeting with some remarks about the recent funeral of our late Hon President Dave Gavine. June and several members attended and Ken Kennedy delivered a eulogy humorous in many aspects as Dave was a very humorous man. June indicated that Dave himself had probably given some input to the planning of the funeral and music played at the funeral included a rendition of Northern Lights of Old Aberdeen by the Jimmy Shand band and the friends and family departed the funeral to the strains of a Laurel and Hardy tune. In many ways it was an uplifting service paying tribute to the life of Dave Gavine.

The guest speaker for the evening was Juan Hernandez Santisteban from St Andrews delivering a presentation: "Echo Mapping of Super Massive Black Holes"

Juan began his talk with some recently produced and very impressive simulations in three dimensions of galaxy evolution from cosmic dawn until now. Moving on to explain there is poor understanding of how blackholes feed, absorbing material and how they evolve. An image of M87 an elliptical galaxy was shown with a massive jet observed at radio wavelengths emanating from the core of the galaxy. This jet is many times longer than the galaxy and it is agreed that active galactic nuclei (AGN) must be powered by black holes accreting material and generating vast amounts of radiation.

The event horizon telescope (EHT) has been able to determine the diameter of the blackhole and it was explained that the EHT has been able to image the front and back of the blackhole due to the gravitational bending of the light. This is a worldwide array of millimetre and submillimetre telescopes making up a complex interferometer.

Juan then showed some diagrams modelling jets and gas flows around the accretion discs of various objects. A compact binary disc diameter is 0.002 AU, a protoplanetary disc is 100 AU and an AGN is 300,000 AU.

Then jumping back in time, a bit to the third Cambridge catalogue of radio sources a radio astronomy project of the 1950s 3C273 was discussed briefly as it was the first Quasar discovered and proved to be extra-galactic. A supermassive black hole is a likely suspect and it is now agreed that Quasars and AGN are one and the same.

The viewing angle of observations determines what information will be obtained as there are different complex mechanisms going on in and around the accretion disc.

We have the gas and dust torus from which jets emerge perpendicular to the torus centre, the broad line region (BLR) in the middle of the torus and the narrow line region lies outside the torus.

The Hercules A radio galaxy has jets terminating in radio lobes which are much larger than the galaxy. The very large telescope (VLT) in Chile consisting of a group of 8 metre telescopes has imaged gas rotating around the jet. However, it has proved too difficult to image the accretion disc itself. An indirect method of observation has been devised termed echo mapping. Hydrogen lines show doppler broadening and wider lines indicate increasing speed. The Sloan Digital Sky Survey (SDSS) employs a perforated plate with fibre optics attached to image individual quasars and the time delay of emissions from the BLR compared to the direct emission from the centre are analysed. It has been found that the delay in one case is 62 light days.

Another problem is determining accretion rate and some progress has been made by looking at the how mass moving towards the blackhole heats up and the radiation wavelength indicates temperature so X- rays are emitted from material at closest approach. There is a transition from infrared to X-ray and expected time lags are 1-2 days so frequent sampling is required but telescope time is a scarce resource.

Information from HST and SWIFT X-Ray telescope show lags do increase with wavelength but the discs appear too big to agree with theory. The Global telescope network provides 24-hour coverage and a test case using the Seyfert 1 galaxy shows 6 days across the disc. Juan showed many graphs of data indicating various time lags for different objects and he is hopeful further research will provide observational data to match the theory.

Jim Barber Sky Notes

Jim payed a short tribute to Dave Gavine and drew members attention to the fact that Dave had an asteroid named after him courtesy of Robert McNaught.

Things to look out for include Virgo realm of galaxies, the Leo triplet, Ursa Major M81 and M82. Ken Kennedy then drew members attention to various lunar features such as Vallis Alpes and viewing Treisnecker as it is very good for rilles.

Phil Rourke then gave a brief overview of a radio meteor detection system he set up at home in the last week using a homemade three element Yagi antenna in the loft

connected to a software defined radio dongle controlled by SDR# software and meteor audio pings analysed by Spectrum Lab. Some screen shots were shown of meteor detections. Further information will be provided at a later date when an external co linear antenna has been installed which should increase the detection rate many fold.

Jim then gave a brief run down on the visibility of the planets, followed by a presentation from Alan Clitherow about imaging Venus. Alan explained he was using a 250 mm Newtonian at F16 and a high frame rate camera ASI290 MM and selecting 5% of images for stacking. This lucky imaging technique has produced some very clear images showing banding from some poor quality AVI runs.

The meeting closed at 2120 and refreshments were then taken by members.

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