Title: Poster Blast

Date: Nov 10, 2014 04:15 PM

URL: http://pirsa.org/14110124

Abstract:


PERIMETER
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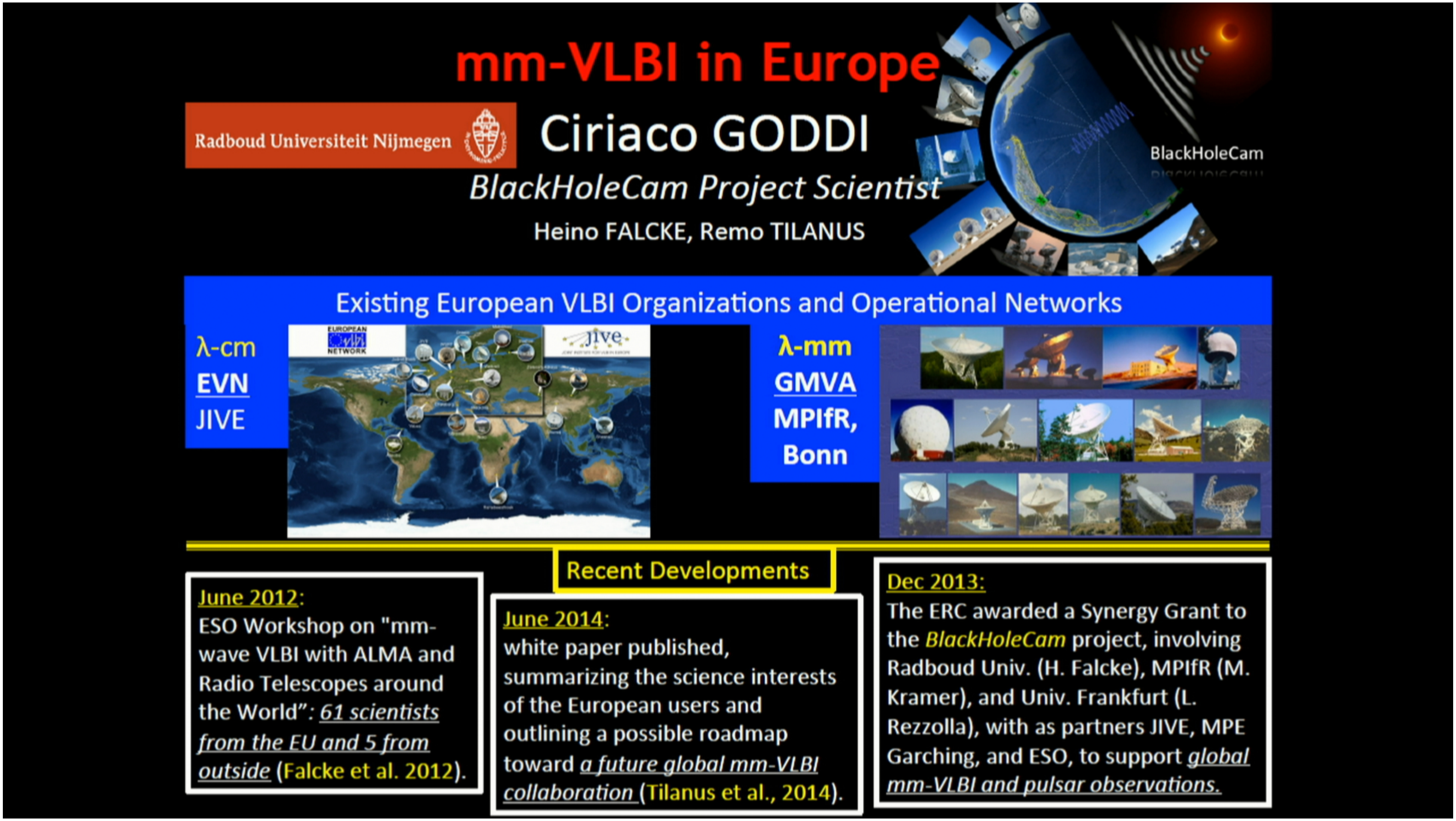
mm-VLBI in Europe
Radboud Universiteit Nijmegen
Ciriaco GODDI
BlackHoleCam Project Scientist
Heino FALCKE, Remo TILANUS
BlackHoleCam
Existing European VLBI Organizations and Operational Networks
λ-cm
EVN
JIVE
EUROPEAN VLBI NETWORK
JIVE
λ-mm
GMVA
MPIfR, Bonn
Recent Developments
June 2012:
ESO Workshop on "mm-wave VLBI with ALMA and Radio Telescopes around the World": 61 scientists from the EU and 5 from outside (Falcke et al. 2012).
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white paper published, summarizing the science interests of the European users and outlining a possible roadmap toward a future global mm-VLBI collaboration (Tilanus et al., 2014).
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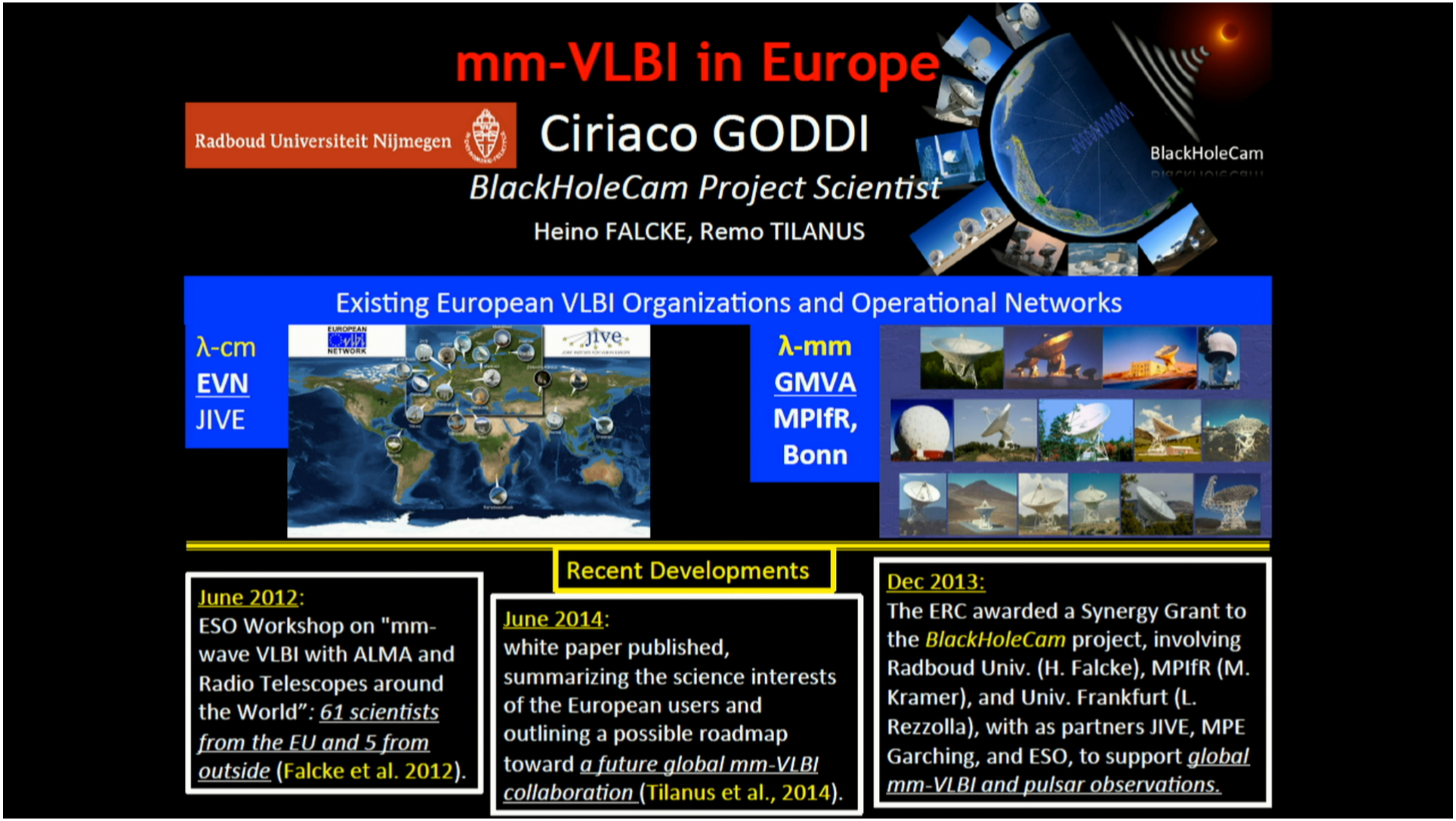
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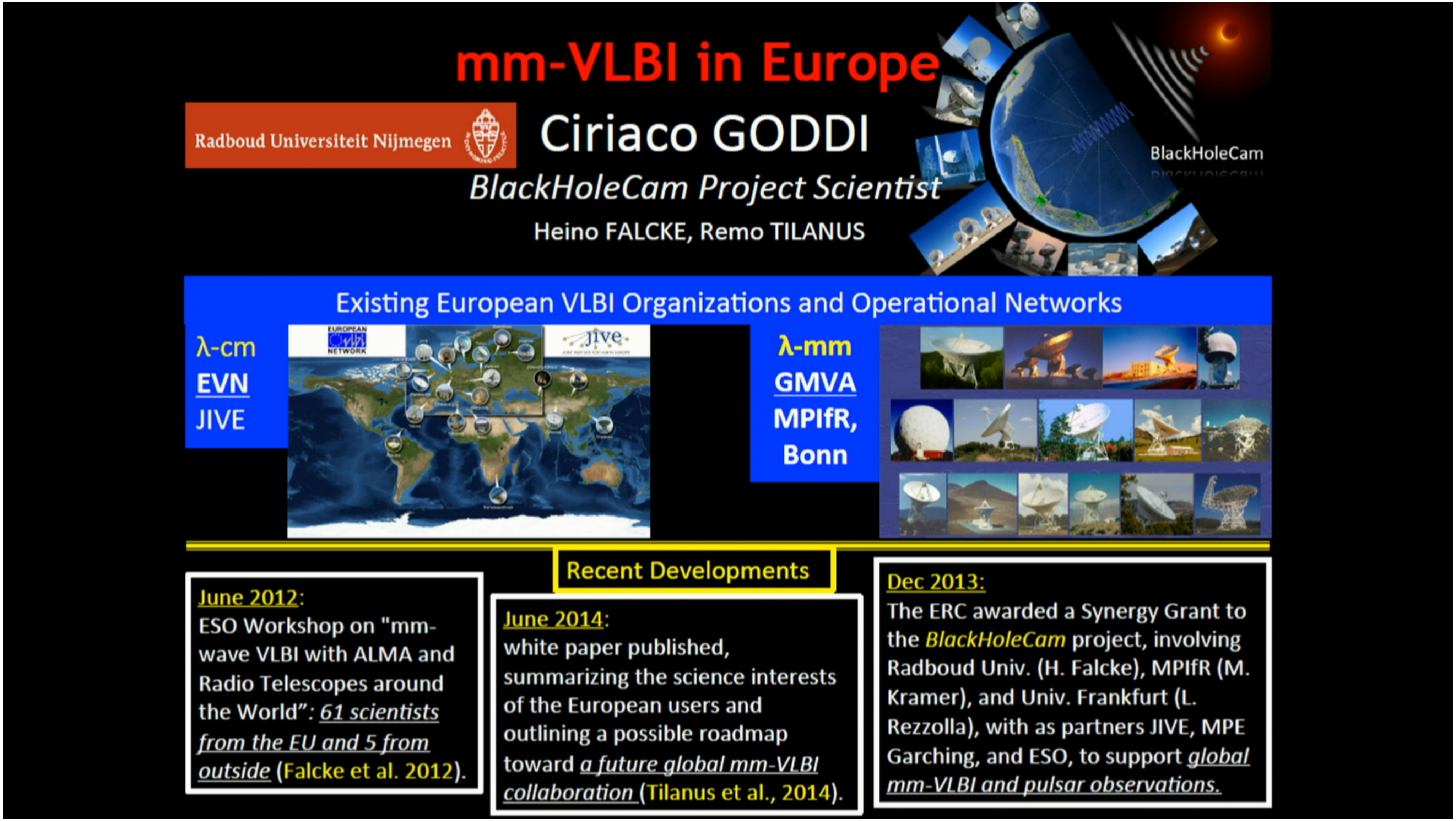
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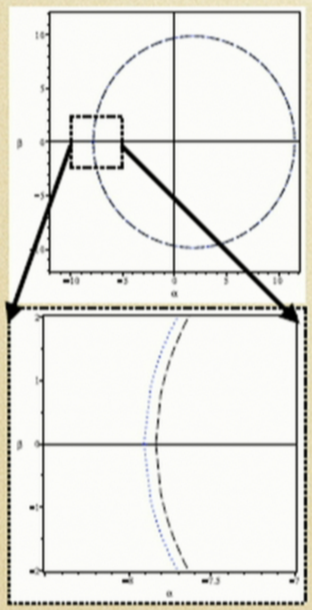
Probing spacetime regularity by measuring the shadow of a black hole

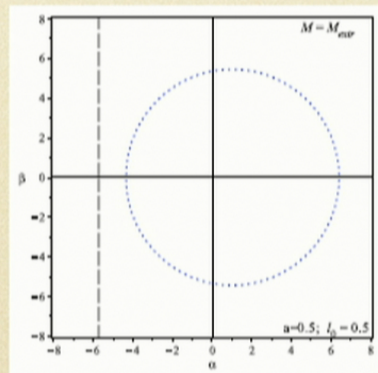
Alejandro **Cárdenas-Avendaño** & Alexis **Larrañaga**
National Astronomical Observatory of Colombia
Bogotá D.C

Black hole Shadows

Solutions with horizons



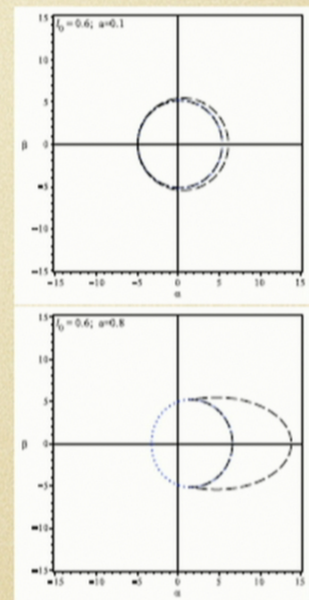
Extremal Solution



Smeared particle-like gravitational source of the form:

$$\rho_G(r) = \frac{M}{8\pi^{\frac{3}{2}} l_0^3} e^{-\frac{r^2}{4l_0^2}}$$

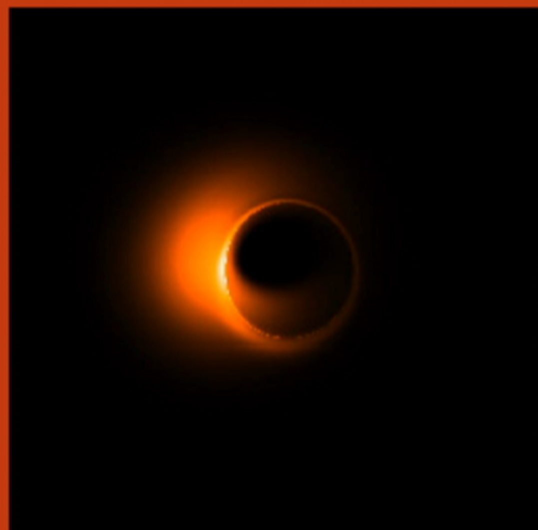
Solutions with no horizons



Imaging Sgr A* through time-variability

Freek Roelofs

Mentors: Heino Falcke, Ru-Sen Lu, Vincent Fish, Shep Doeleman



Average of GRMHD movie (Shiokawa)

Result after observing the movie for eight days and averaging, normalizing and smoothing the visibilities

HAYSTACK OBSERVATORY

Radboud University Nijmegen

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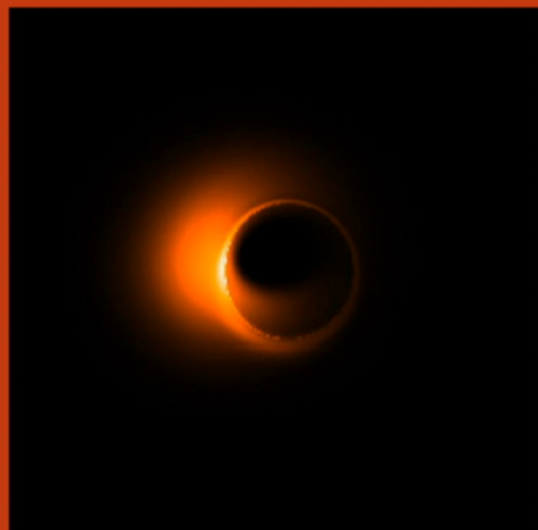

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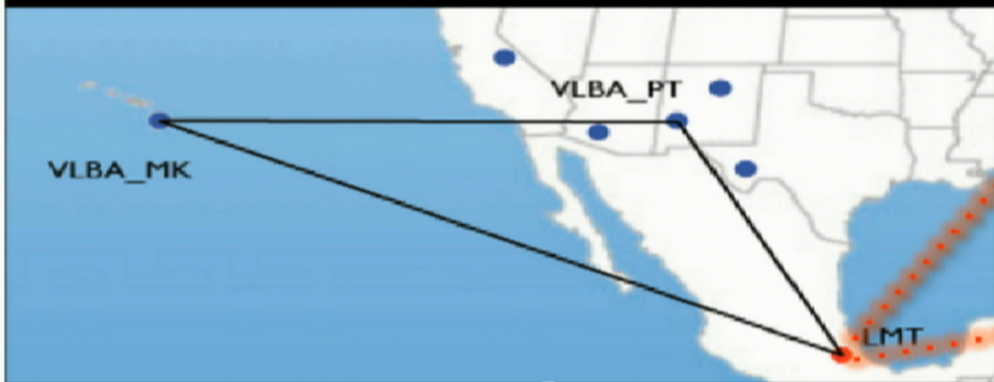
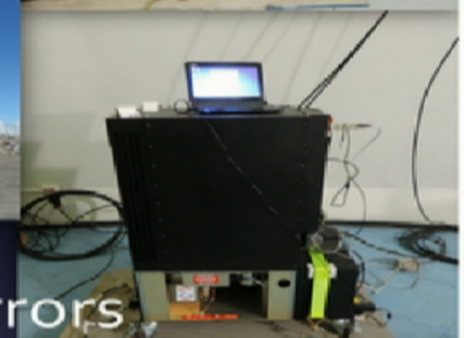
HAYSTACK OBSERVATORY

Radboud University Nijmegen

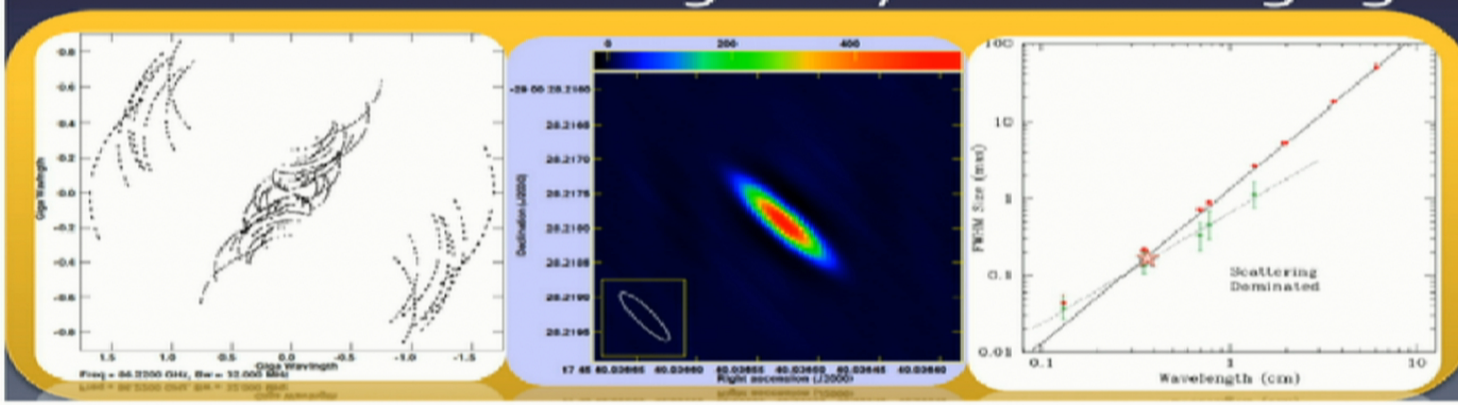
Testing a 3 mm VLBI system a the Large Millimeter Telescope: Observations of Sgr A*

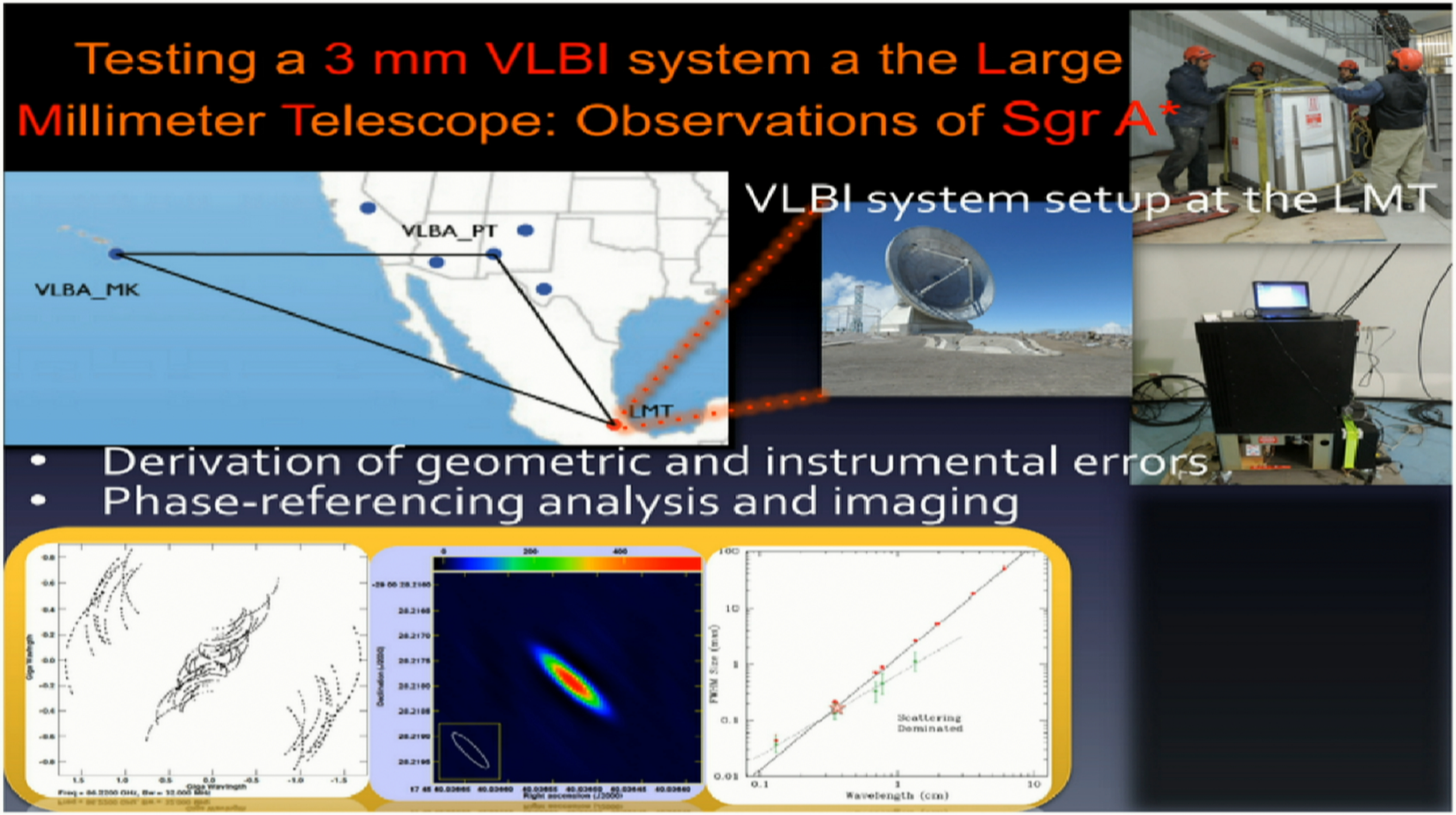


VLBI system setup at the LMT



- Derivation of geometric and instrumental errors
- Phase-referencing analysis and imaging

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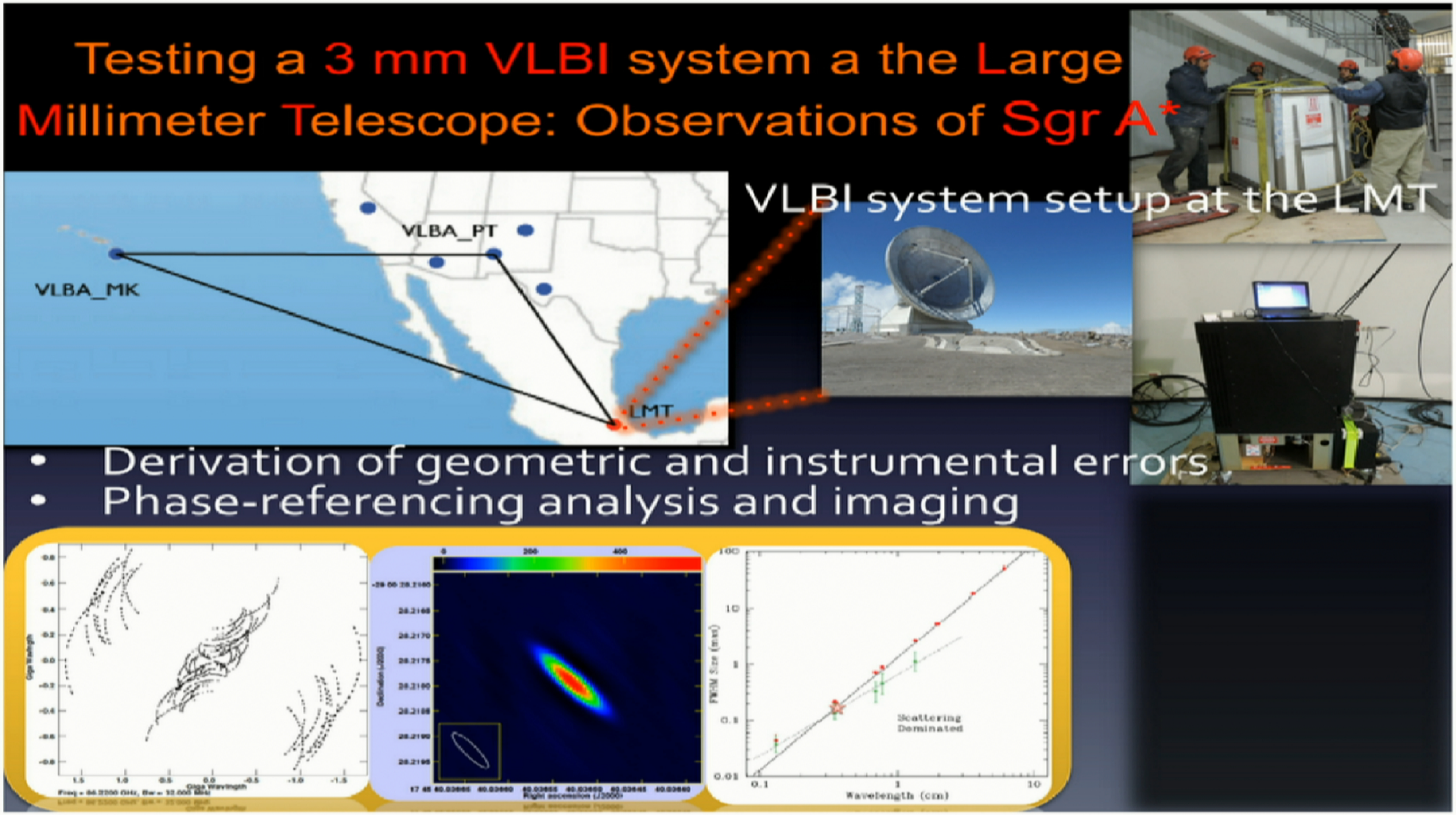
Scattering Dominated
Wavelength (cm)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Probing the magnetic field in the vicinity of supermassive AGN black holes with RadioAstron at 33 µas angular resolution

J. L. Gómez, A. Lobanov, G. Bruni, U. Bach, Y. Kovalev, K. Sokolovsky, A. P. Marscher, S. G. Jorstad, for the KSP team

RadioAstron

Space-VLBI mission capable of achieving an angular resolution of ~10 µas at λ=1.3 cm.

Polarization Key Science Program

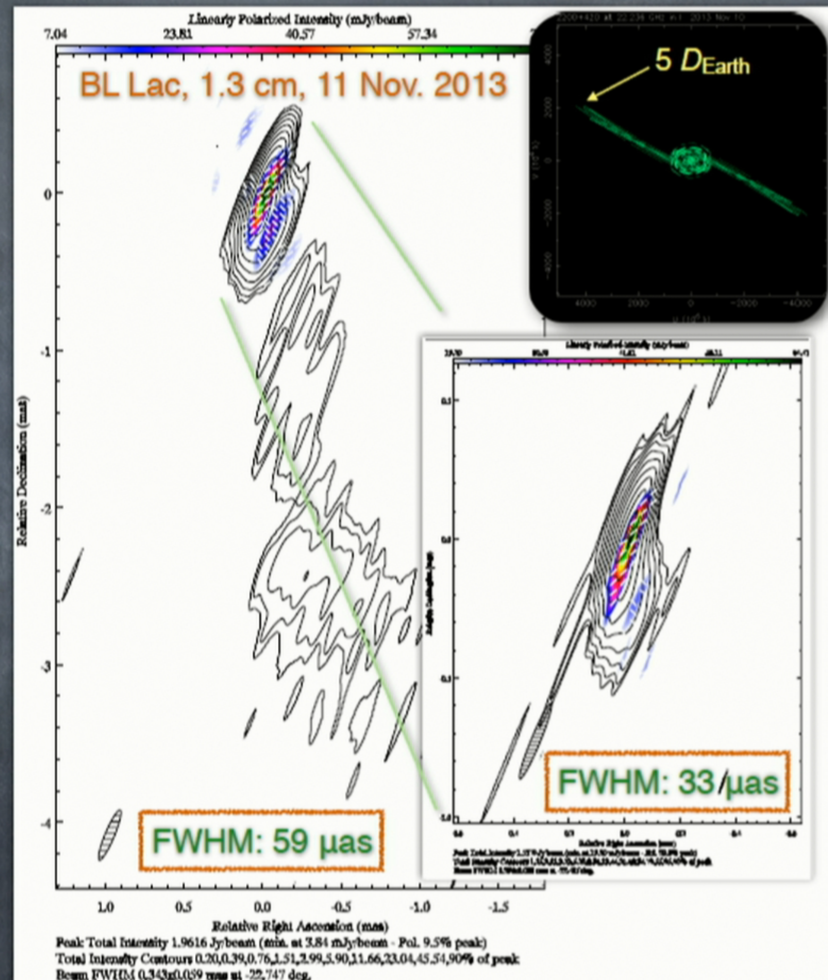
Aimed to probe the innermost regions of AGN jets and their magnetic field. First year observed targets: BL Lac, 3C273, 3C279, OJ287.

BL Lac at 1.3 cm with RadioAstron

First successful space-VLBI observations at 1.3 cm, with ground-space detections for up to 5 D_{Earth} (4800 Mλ), achieving a maximum angular resolution of 33 µas (2600 R_s), the highest to date.

BL Lac shows a bent structure in the innermost 0.3 mas, with two components in polarization showing orthogonal EVPAs.

Confirmed RadioAstron polarization capabilities to probe AGN jets with angular resolutions of ≲30 µas



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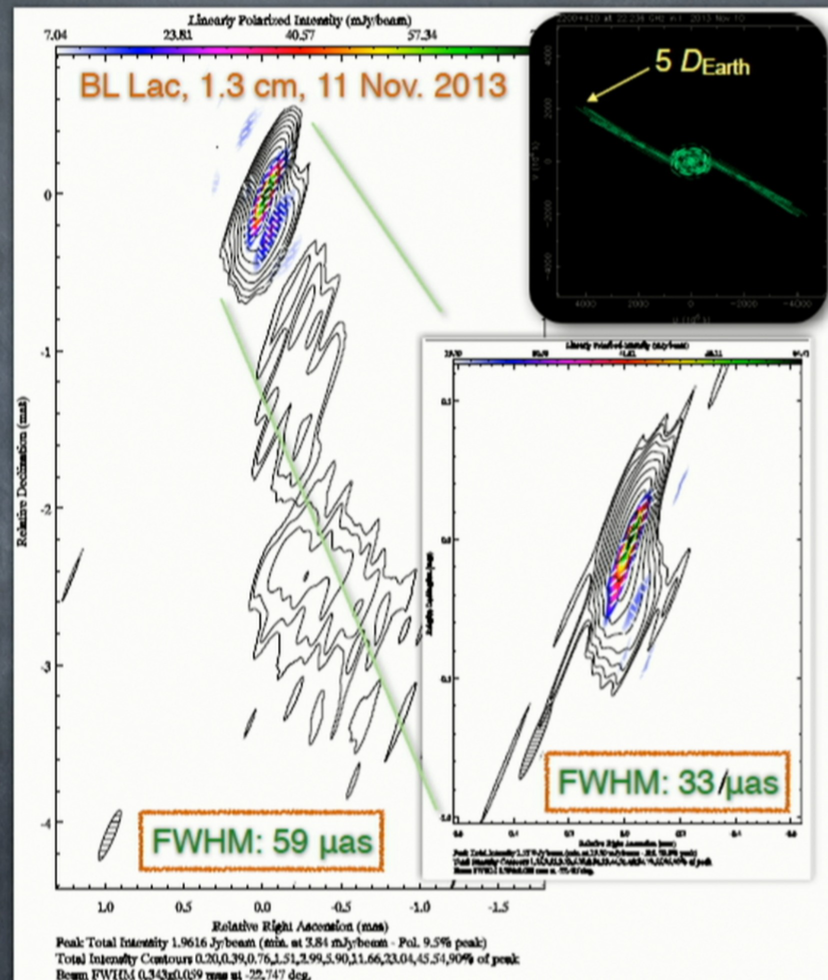
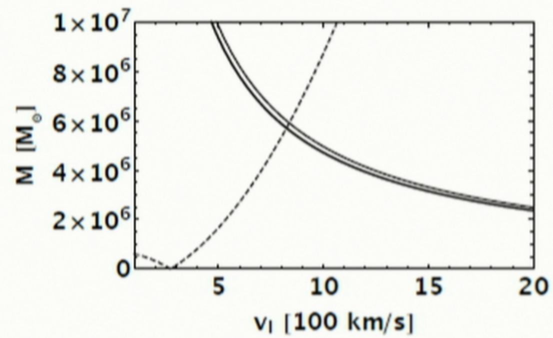


Pulsars as Probes of Sag A* and its Environments

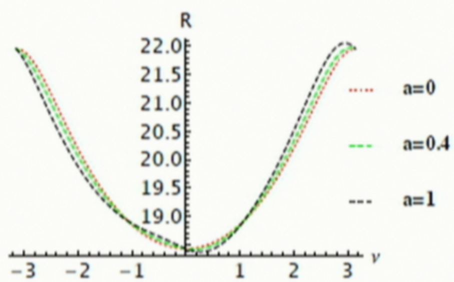
Pierre Christian, Dimitrios Psaltis, and Abraham Loeb

Pulsar time delay can be used to probe a host of stuff!

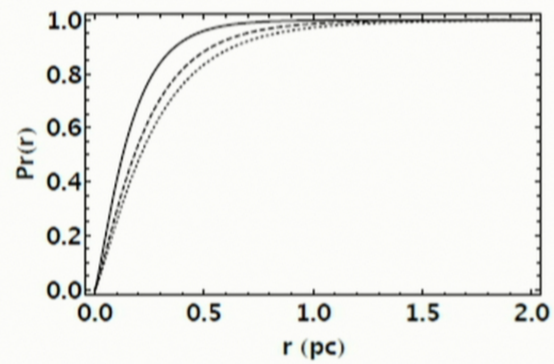
Probing the cumulative stellar mass



Probing the metric

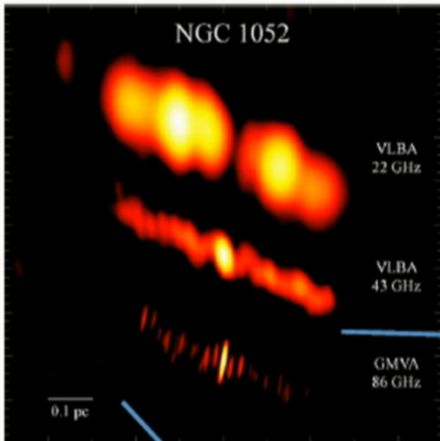


Probing the characteristic stellar mass



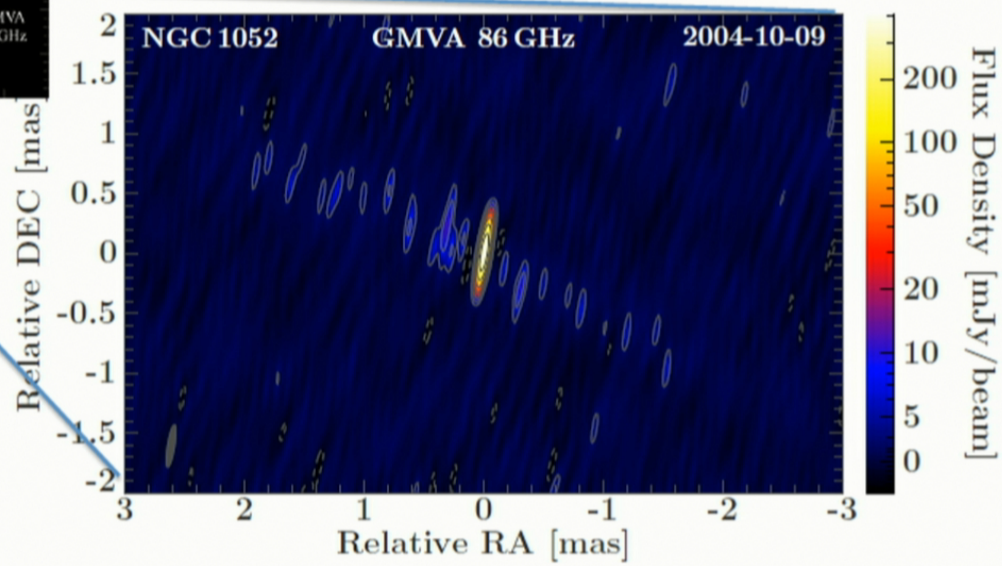
mm-VLBI observations of NGC 1052

Ros, Baczko*, Schulz, Kadler, Krichbaum, Böck, & Wilms



- Radio-loud LINER object at 20 Mpc, $M_\bullet \sim 10^{8.2}\, M_\odot$
- Twin jet, gap at cm-wavelengths
- One component dominates at mm-wavelengths
- 86-GHz GMVA imaging reveals a double-sided structure
- **Key source for EHT obs. of central engine environment**

$T_b > 5\times10^{11}$ K
Emission region < 8.6 µas
Distance BH-jet base < 25 R_s



*: Principal investigator

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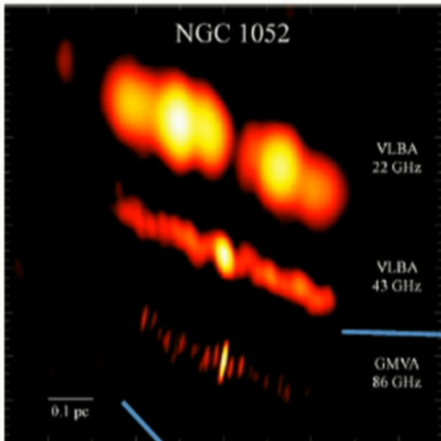

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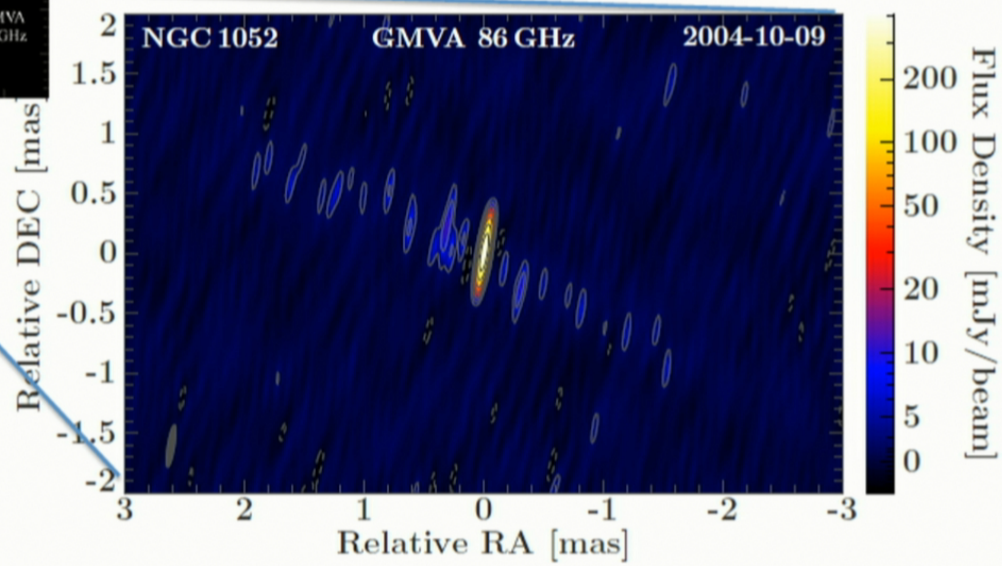


*: Principal investigator

M87 Imaging with Sparse Modeling

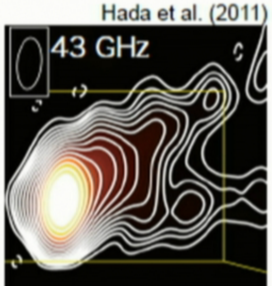
Fumie Tazaki[1], Mareki Honma[1], Kazunori Akiyama[1,2], Kazuhiro Hada[1], Shiro Ikeda[3], Makoto Uemura[4], & Seijyu Kudo[5] ([1]NAOJ, [2]U. Tokyo, [3]ISM, [4]Hiroshima U., [5]Kyushu U.)

Sparse modeling:

- A technique which selects an optimum sparse solution from linear ill-posed equations.
- A breakthrough in the detailed imaging with VLBI, which has been highly affected by the incomplete sampling of visibilities.

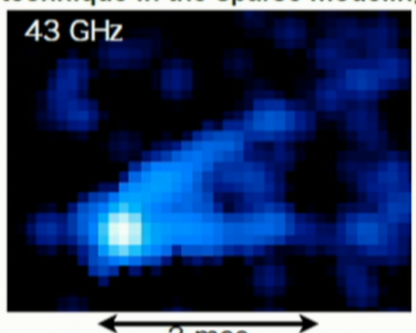
Standard Method

Hada et al. (2011)



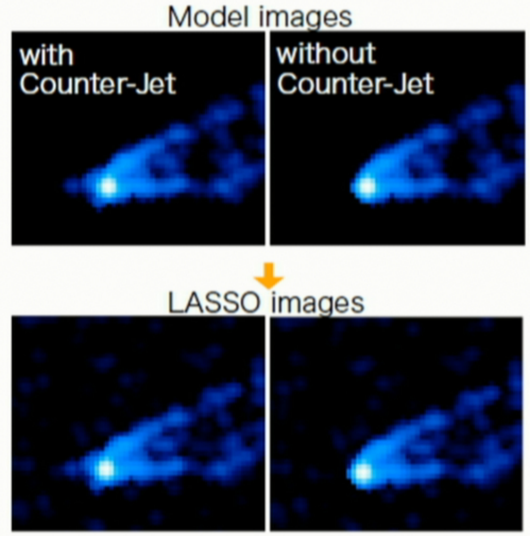
LASSO

(a technique in the sparse modeling)



Limb-brightening and counter-jet-like structures in LASSO images!!

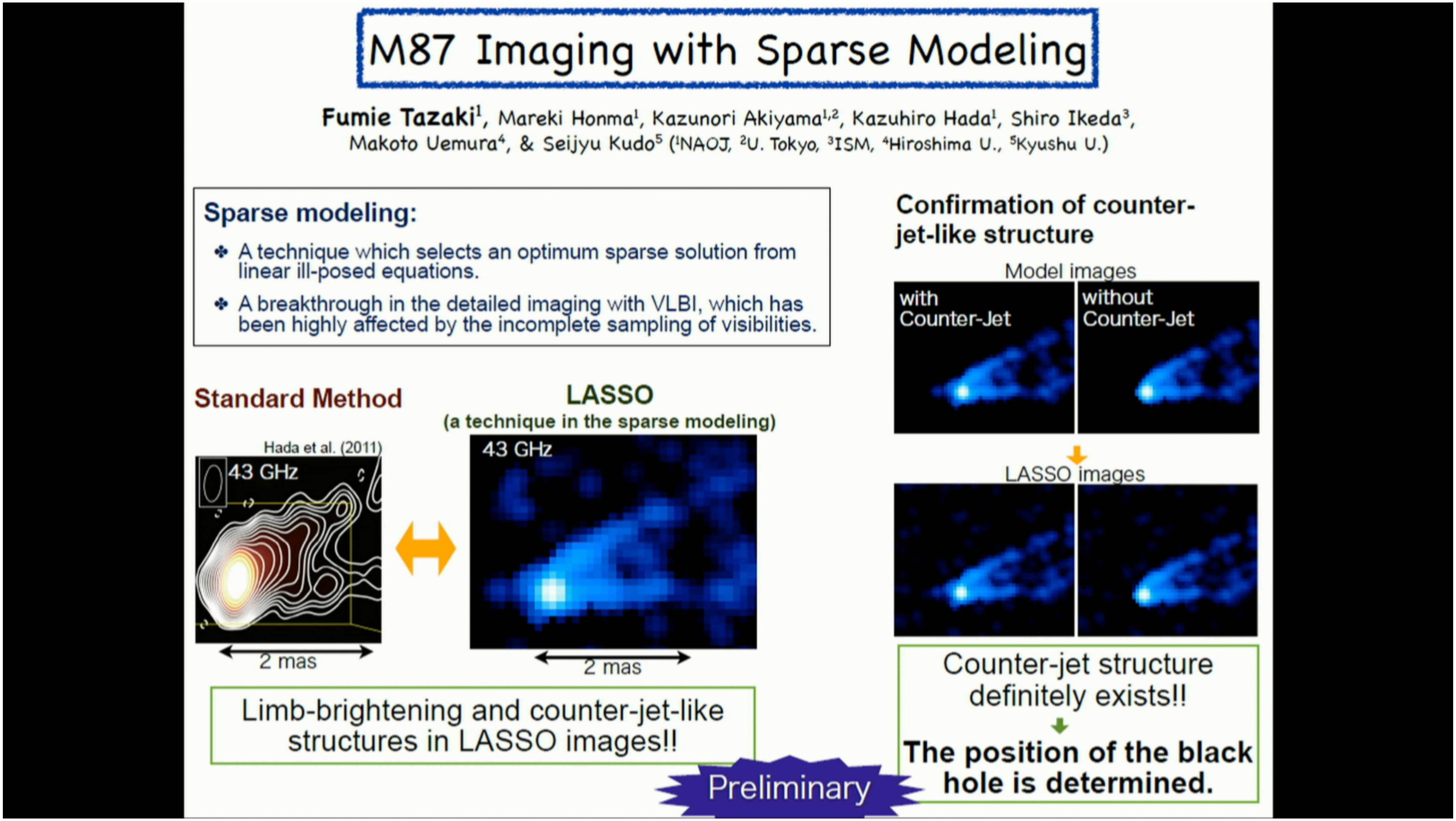
Confirmation of counter-jet-like structure



Counter-jet structure definitely exists!!

The position of the black hole is determined.

Preliminary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Standard Method
Hada et al. (2011)
43 GHz
2 mas
LASSO
(a technique in the sparse modeling)
43 GHz
2 mas
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Confirmation of counter-jet-like structure
Model images
with Counter-Jet
without Counter-Jet
LASSO images
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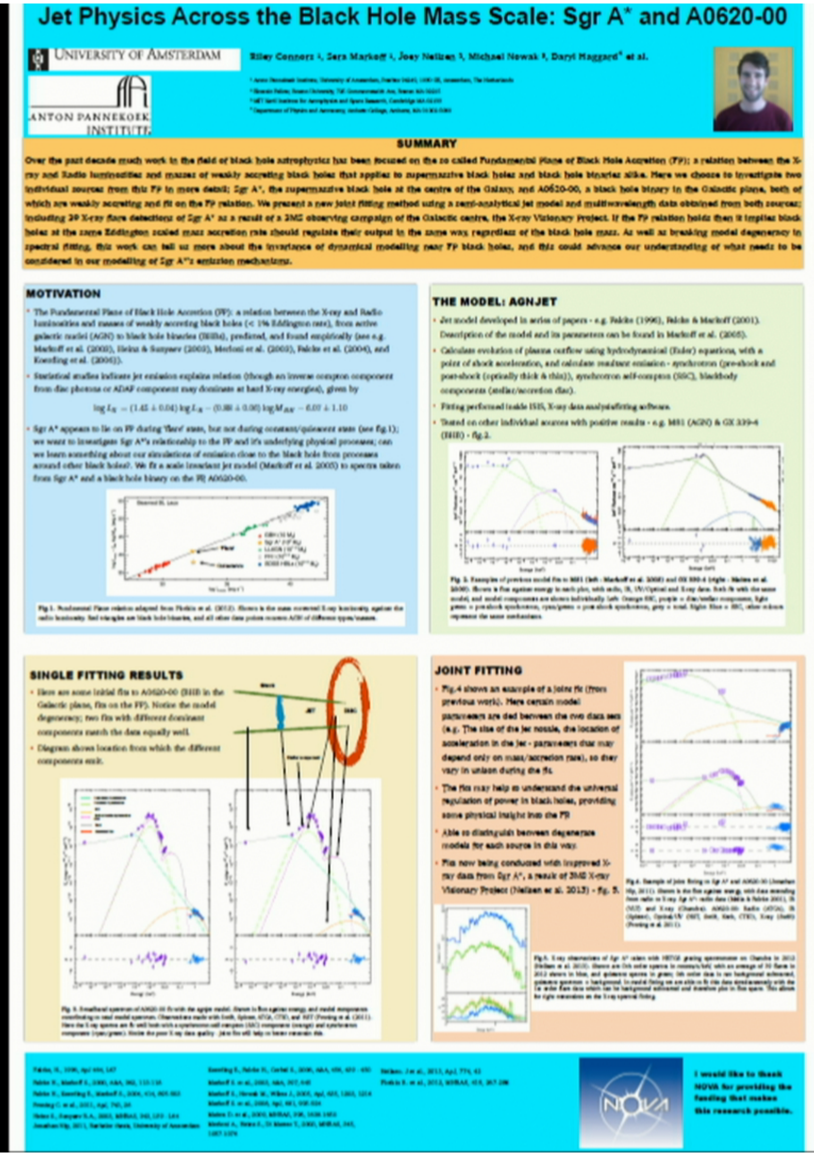
Jet Physics Across the Black Hole Mass Scale: Sgr A* and A0620-00
UNIVERSITY OF AMSTERDAM
ANTON PANNEKOEK INSTITUTE
Riley Connors, Sera Markoff, Joey Neilsen, Michael Nowak, Daryl Haggard et al.
SUMMARY
Over the past decade much work in the field of black hole astrophysics has been focused on the so called Fundamental Plane of Black Hole Accretion (FP); a relation between the X-ray and Radio luminosities and masses of weakly accreting black holes that applies to supermassive black holes and black hole binaries alike. Here we choose to investigate two individual sources from this FP in more detail; Sgr A*, the supermassive black hole at the centre of the Galaxy, and A0620-00, a black hole binary in the Galactic plane, both of which are weakly accreting and fit on the FP relation. We present a new joint fitting method using a semi-analytical jet model and multiwavelength data obtained from both sources; including 39 X-ray flare detections of Sgr A* as a result of a 3MS observing campaign of the Galactic centre, the X-ray Visionary Project. If the FP relation holds then it implies black holes at the same Eddington scaled mass accretion rate should regulate their output in the same way, regardless of the black hole mass. As well as breaking model degeneracy in spectral fitting, this work can tell us more about the invariance of dynamical modelling near FP black holes, and this could advance our understanding of what needs to be considered in our modelling of Sgr A*'s emission mechanisms.
MOTIVATION
The Fundamental Plane of Black Hole Accretion (FP): a relation between the X-ray and Radio luminosities and masses of weakly accreting black holes (< 1% Eddington rate), from active galactic nuclei (AGN) to black hole binaries (BHBs), predicted, and found empirically
Statistical studies indicate jet emission explains relation (though an inverse compton component from disc photons or ADAF component may dominate at hard X-ray energies), given by
Sgr A* appears to lie on FP during 'flare' state, but not during constant/quiescent state (see fig.1); we want to investigate Sgr A*'s relationship to the FP and it's underlying physical processes; can we learn something about our simulations of emission close to the black hole from processes around other black holes? We fit a scale invariant jet model (Markoff et al. 2005) to spectra taken from Sgr A* and a black hole binary on the FP, A0620-00.
THE MODEL: AGNJET
Jet model developed in series of papers - e.g. Falcke (1996), Falcke & Markoff (2001). Description of the model and its parameters can be found in Markoff et al. (2005).
Calculates evolution of plasma outflow using hydrodynamical (Euler) equations, with a point of shock acceleration, and calculate resultant emission - synchrotron (pre-shock and post-shock (optically thick & thin)), synchrotron self-compton (SSC), blackbody components (stellar/accretion disc).
Fitting performed inside ISIS, X-ray data analysis/fitting software.
Tested on other individual sources with positive results - e.g. M81 (AGN) & GX 339-4 (BHB) - fig.2.
SINGLE FITTING RESULTS
Here are some initial fits to A0620-00 (BHB in the Galactic plane, fits on the FP). Notice the model degeneracy; two fits with different dominant components match the data equally well.
Diagram shows location from which the different components emit.
JOINT FITTING
Fig.4 shows an example of a joint fit (from previous work). Here certain model parameters are tied between the two data sets (e.g. The size of the jet nozzle, the location of acceleration in the jet - parameters that may depend only on mass/accretion rate), so they vary in unison during the fit.
The fits may help to understand the universal regulation of power in black holes, providing some physical insight into the FP
Able to distinguish between degenerate models for each source in this way.
Fits now being conducted with improved X-ray data from Sgr A*, a result of 3MS X-ray Visionary Project (Neilsen et al. 2013) - fig. 5.
NOVA
I would like to thank NOVA for providing the funding that makes this research possible.


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INSTITUTE
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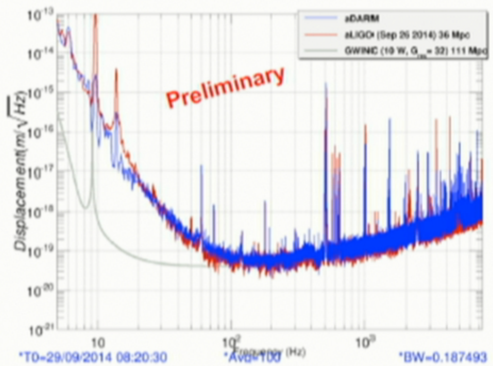
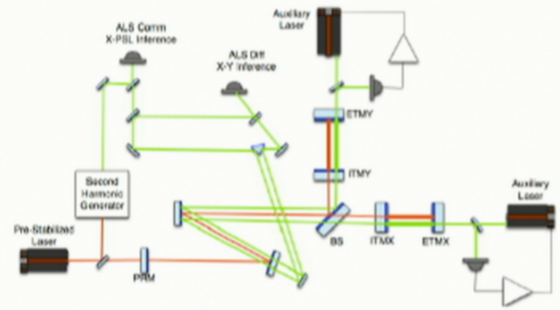
Advanced LIGO Detector Status



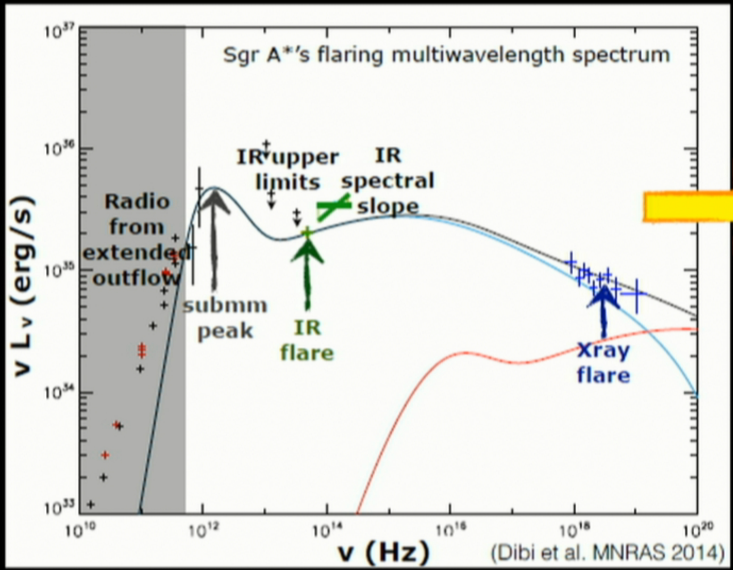


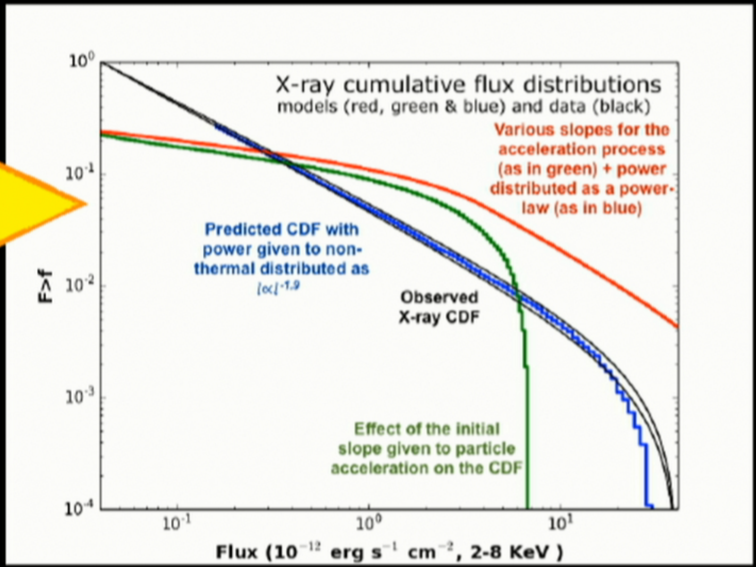
M. Landry
for the LIGO Scientific Collaboration
LIGO Hanford Observatory/Caltech

Emission mechanisms from Sgr A*'s inner gravitational radii

Model calculating particle distributions self-consistently and giving the resulting spectrum

+ Model generating distribution of fluxes over thousands of emission events

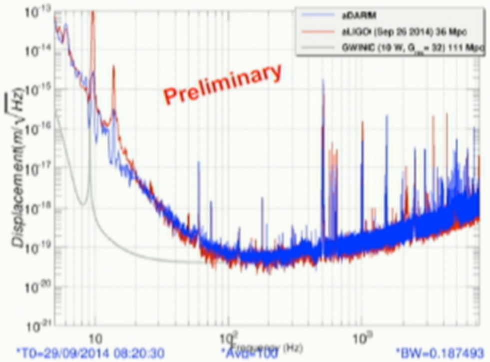


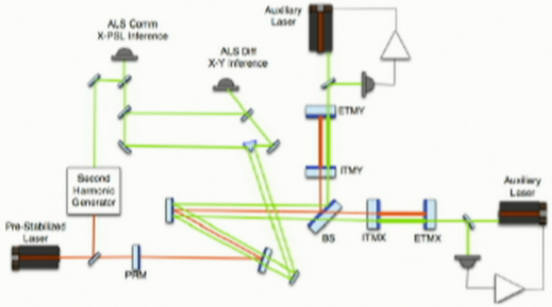


Limitations: studying each different event, lack of simultaneous multiwavelength data.

Overcome the lack of number and simultaneous events + describe the behaviour of physical parameters

Advanced LIGO Detector Status





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