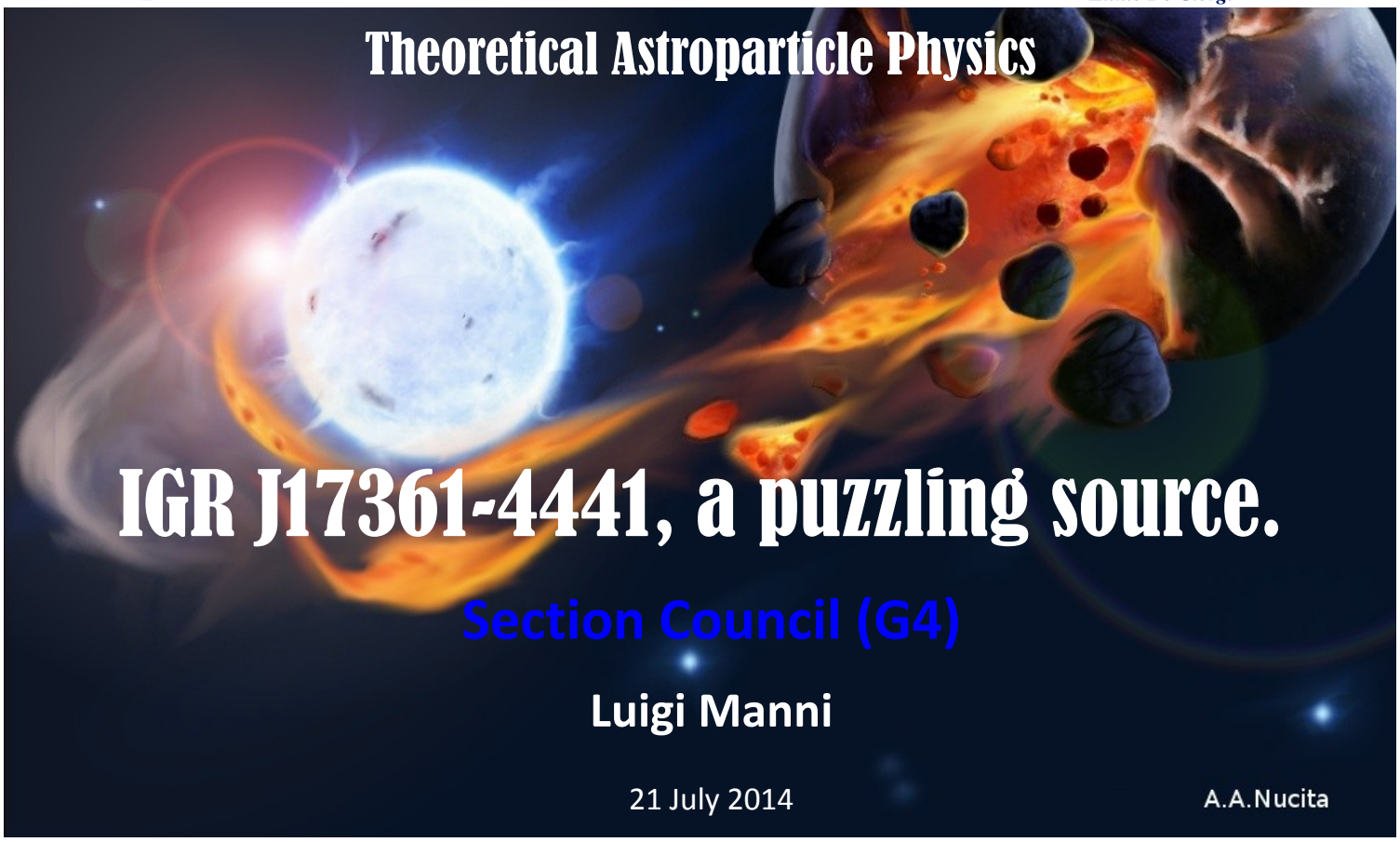
UNIVERSITÀ DEL SALENTO

INFN

Dipartimento di Matematica e Fisica
"Ennio De Giorgi"



Theoretical Astroparticle Physics

IGR J17361-4441, a puzzling source.

Section Council (G4)

Luigi Manni

21 July 2014

A.A.Nucita

Some Missing High-Energy Sources

Among the high-energy astrophysical sources there are the intriguing Black Holes that can be classified, via their mass, in:

3 $M_\odot$ < StMBH < 20 $M_\odot$ **10^6 $M_\odot$ < SMBH < 10^9 $M_\odot$**

The gap between the previous classes could be filled up by the so called **IMBH**.
They may be linked to the latter stage of a super-massive star or may be due to the normal ones merging. If they don't interact to form SMBH may remain as isolated primordial seeds of the Universe.

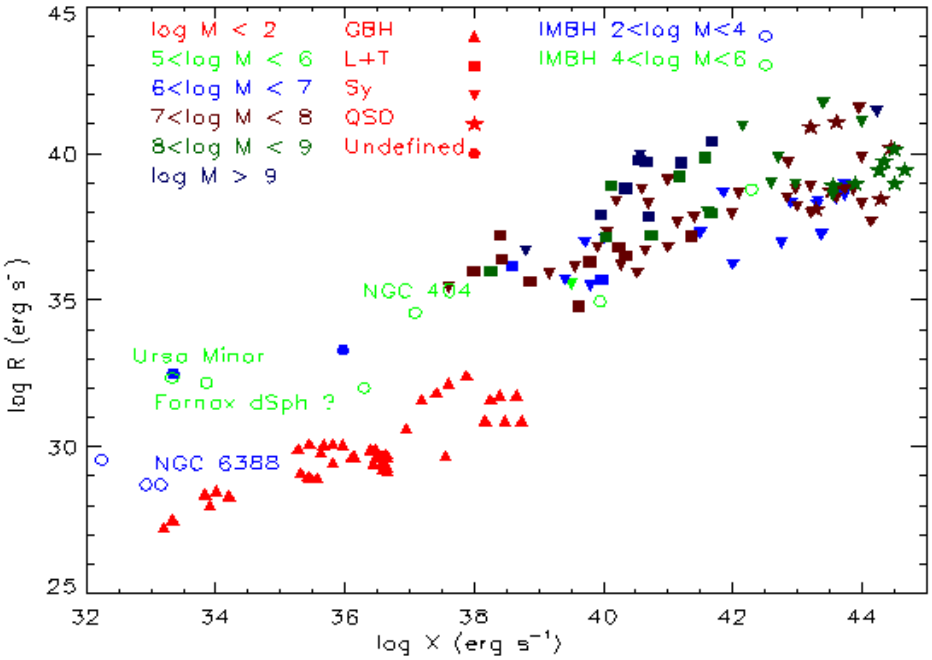
10^2 $M_\odot$ < IMBH < 10^5 $M_\odot$

Just in the 2011-2012, through a coincidence of the central X-ray source with a radio one, it was possible to obtain the 10^5 - 10^6 $M_\odot$ constraint on the mass of the BH in **Henize2-10** (dSph) and **NGC 404** (GC).
Therefore, the research on IMBHs, dSphs and GCs is recent and rapidly growing up.

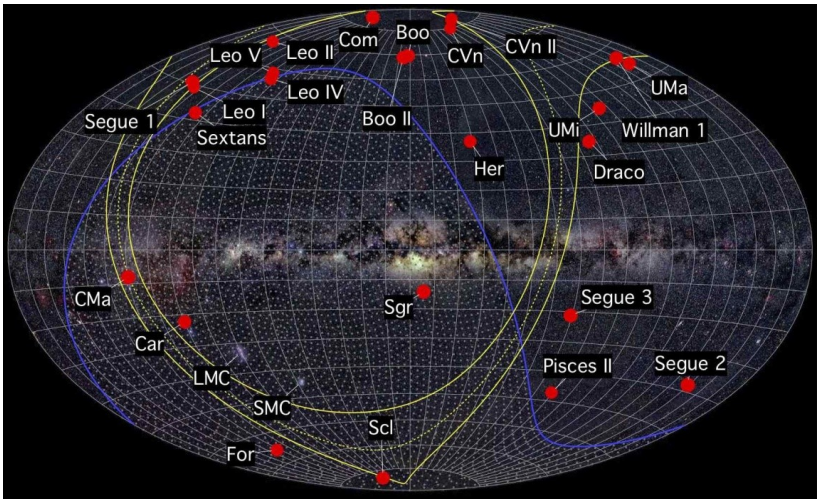
An empirical link

The Fundamental Plane Relation proposed by Merloni

$$\log(L_R) = \xi_{RX} \log(L_X) + \xi_{RM} \log(M_{BH}) + b_R$$



Possible Environments for IMBH: dSphs

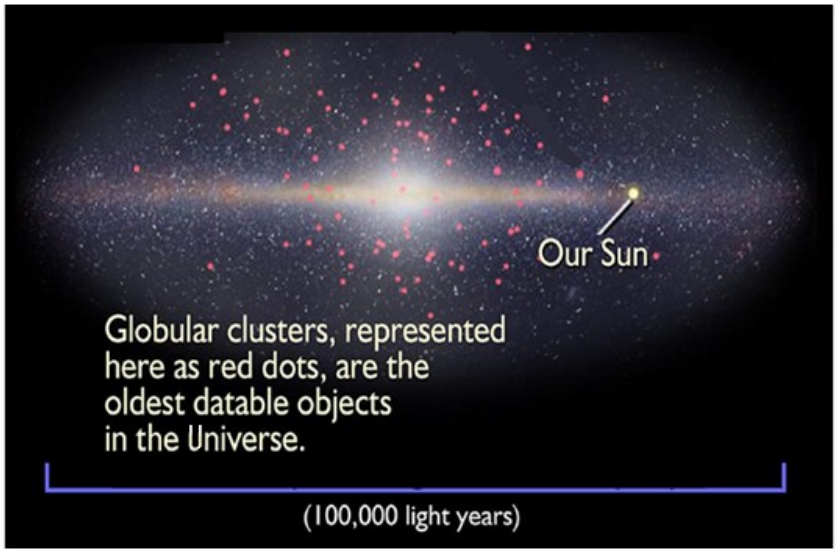


The dwarf spheroidal galaxies (**dSphs**) are low luminosity star systems which seem to be characterized by structural parameters (luminosity, stellar scale length) fundamentally different with respect to those found in spiral and elliptical galaxies. They show a large value of mass-to-light ratio, probably due to the presence of dark matter.

$$3 \cdot 10^3 M_\odot < M_{dSph} < 2 \cdot 10^7 M_\odot$$

Possible Environments for IMBH: GCs

GCs can be considered as a scaled version of galaxy bulges with spherical shapes and relatively high stellar densities toward their centers.



$10^4\ M_\odot < M_{GC} < 10^5\ M_\odot$

AN INTRIGUING GC: NGC 6388

distance = 11.5 kpc **mass = 2.6 × 10^6 $M_\odot$**

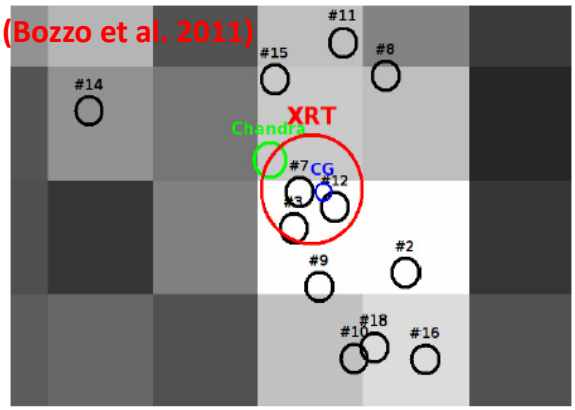
2005 Claim of an IMBH in this GC

2007 $M_{BH} \simeq 5700\ M_\odot$

2008 Some X-ray unresolved sources in the galaxy centre

2010 It's possible to consider only source # 12 and obtain $M_{BH} \simeq 1500\ M_\odot$

2010 With update ATCA data, $M_{BH} \simeq 600\ M_\odot$ for #12 source
If the IMBH is on #7, $M_{BH} \simeq 1200\ M_\odot$



August 11, 2011 A new hard X-ray source close to NGC 6388 centre

VS

November 05, 2011 The source was no longer observable

AN INTRIGUING GC: NGC 6388

distance = 11.5 kpc **mass = 2.6 × 10^6 $M_\odot$**

2005 Claim of an IMBH in this GC

2007 $M_{BH} \simeq 5700\ M_\odot$

2008 Some X-ray unresol
source

Mon. Not. R. Astron. Soc. 000, 1–9 (2014) Printed 16 July 2014 (MN LATEX style file v2.2)

The puzzling source IGR J17361–4441 in NGC 6388: a possible planetary tidal disruption event

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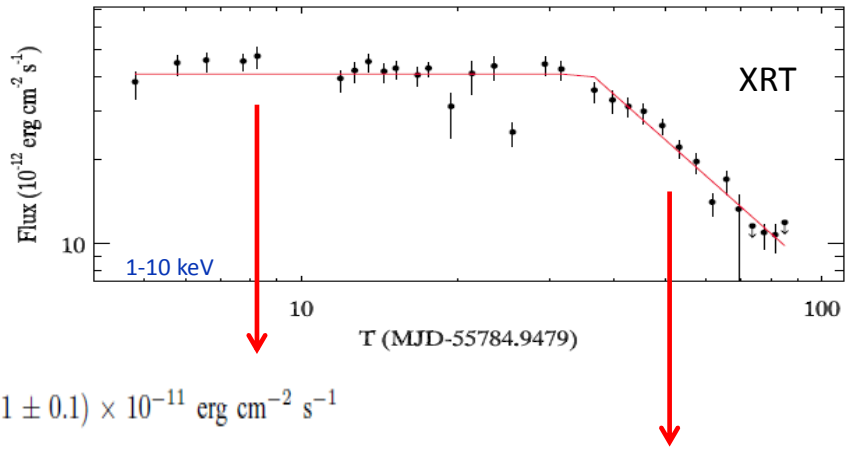
Au centre

November 05, 2011 The source was no longer observable

AN INTRIGUING GC: NGC 6388

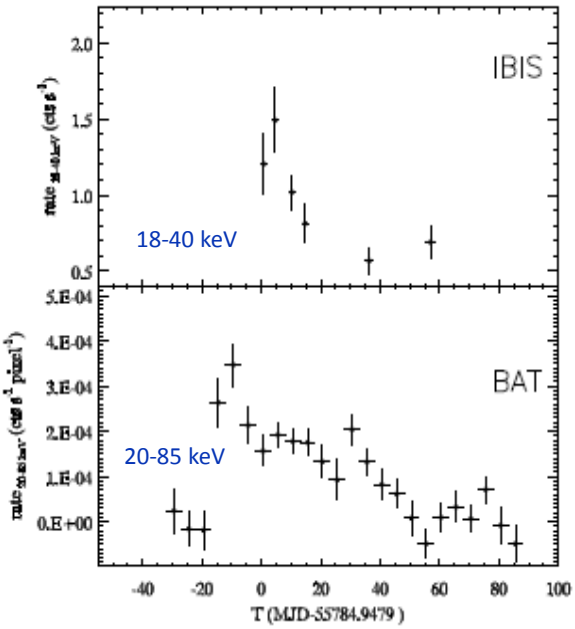
We studied further **IGR 17361-4441** by Swift and INTEGRAL satellites to improve the quality of the fit representing source behaviour after the flare.



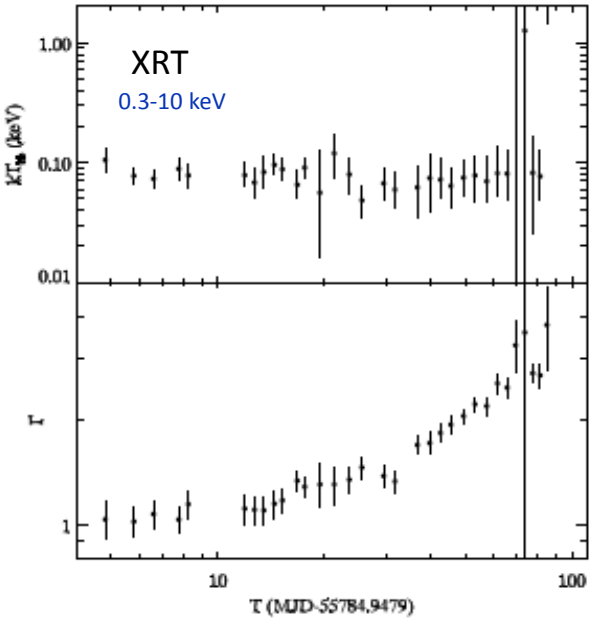
$F_{max} = (4.1 \pm 0.1) \times 10^{-11}$ erg cm^{-2} s^{-1}

High-energy data show a sharp decrease

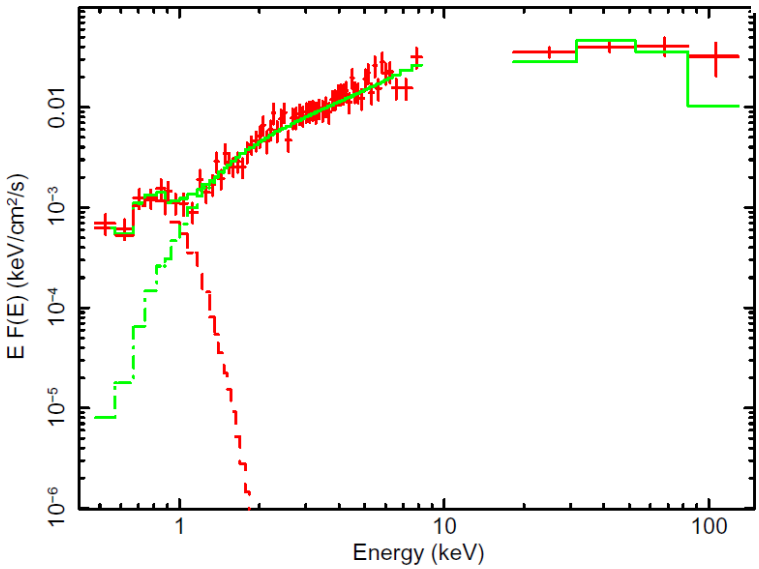
AN INTRIGUING GC: NGC 6388



SPL + DISKBB



AN INTRIGUING GC: NGC 6388



CUTOFFPL + DISKBB

$N_H \simeq 0.7 \times 10^{22}\ cm^{-2}$
$\Gamma_0 = 0.8$
$kT_{bb} \simeq 0.089$ keV
$E_c \simeq 41$ keV

COMPTT + DISKBB

$N_H \simeq 0.7 \times 10^{22}\ cm^{-2}$ $F_{bol} = 1.7 \times 10^{-9}$ erg cm^{-2} s^{-1}

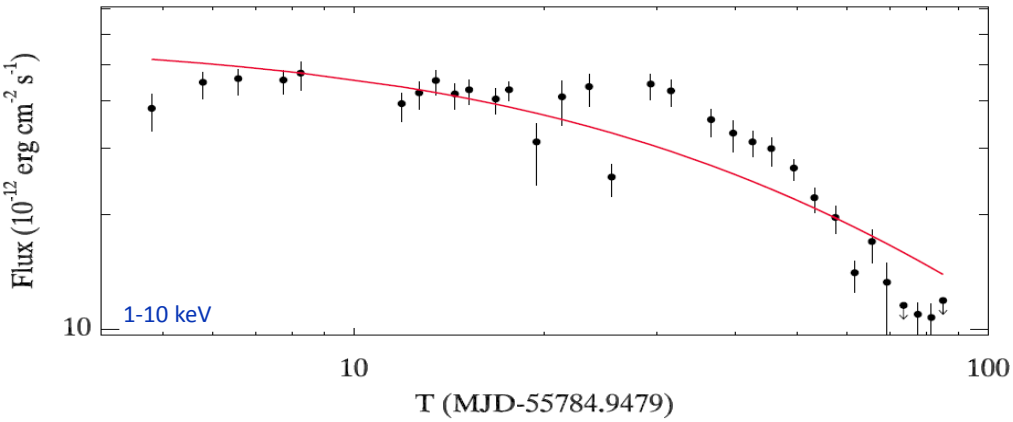
$kT_{bb} \simeq 0.087$ keV $kT_e \simeq 12$ keV

AN INTRIGUING GC: NGC 6388

Some hypotheses for the nature of this astronomical object:

- VFXT => LMXB; ⊘ $L_{2\text{-}10\ keV} = 8.5 \times 10^{35}$ erg s^{-1} unusual Γ_0
- (pulsar) NS; ⊘ lack of pulsations and unusual $L_{quiescent}$
- BH; ⊘ no QPO and radio emission

AN INTRIGUING GC: NGC 6388



- **local/extra-galactic tidal disruption**.

$$M_{\rm mb} \approx 1.9 \times 10^{27} \left(\frac{M}{M_{\rm Ch}}\right) \ {\rm g}$$

with $\dot{N}_{\rm TE} \simeq 3 \times 10^{-5} {\rm yr}^{-1}$

$$\dot{M}_{\rm mb} = \dot{M}_{\rm p} \left(\frac{t + t_{\rm min}}{t_{\rm min}}\right)^{-5/3}$$

$N_{AGN} = 10^{-4}$

$D \approx 160$ Mpc

no extended source


A.A.Nucita