Title: Constraints on Sgr A*'s accretion geometry and plasma characteristics from the 3Msec Chandra (+ multiwavelength) campaign

Date: Nov 10, 2014 11:10 AM

URL: http://pirsa.org/14110066

Abstract: Sgr A* is one of the few black holes whose capture radius is just resolvable with the <0.5― spatial resolution of the Chandra X-ray Observatory. Motivated by this potential we proposed for the deepest ever view of our Galactic center in 2012, via a Chandra-HETGS â€eX-ray Visionary Project―. Involving over 60 members of the Galactic center community, we obtained ~35 days of observations within a single year, for the first time also using the spectral gratings. This campaign doubled the photon count compared to the 12 years of observations before, and involved simultaneous observations from radio through gamma-ray frequencies. We are still analyzing these data sets, in combination with ongoing monitoring campaigns since, which together provide key constraints for the modeling of Sgr A* and environs necessary for the Event Horizon Telescope. I will present the highlights of this campaign so far, with a focus on results that can alter/define our ideas about the accretion geometry and plasma conditions near the black hole.</p>

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Open questions important for EHT modeling of Sgr A*

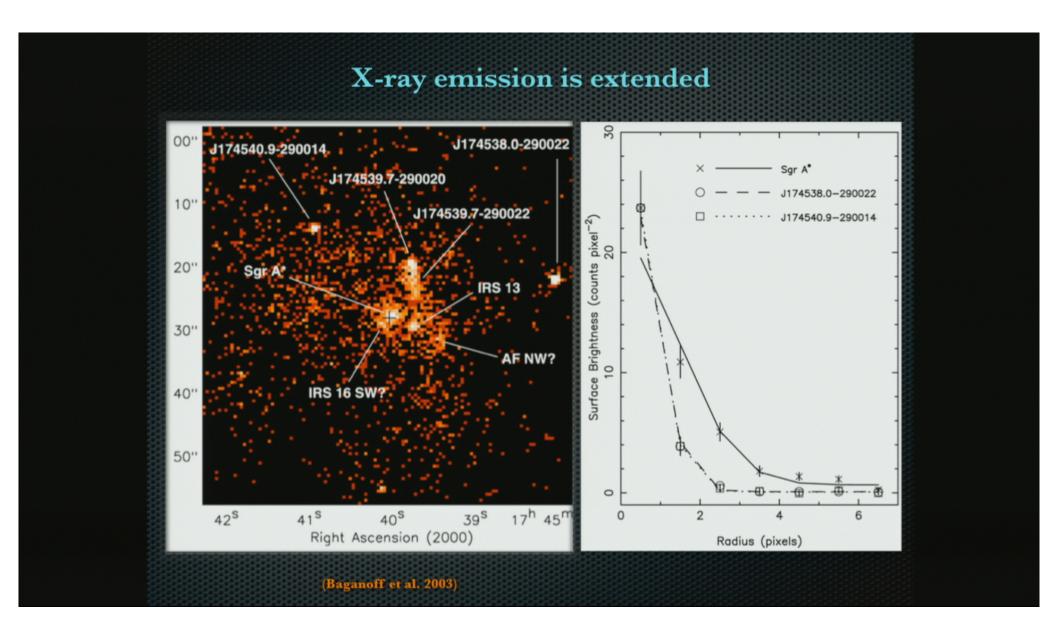
- **★ Fueling →** What are the outer boundary conditions initiating the accretion flow?
- **★ Geometry** Inflow and outflow characteristics? Jets vs winds? Simulations vs reality?
- ★ Plasma characteristics Gas state: thermal vs.
 nonthermal, T_e/T_i, particle acceleration and
 distributions ("painting" simulations)
- **★** Shape of spacetime?...

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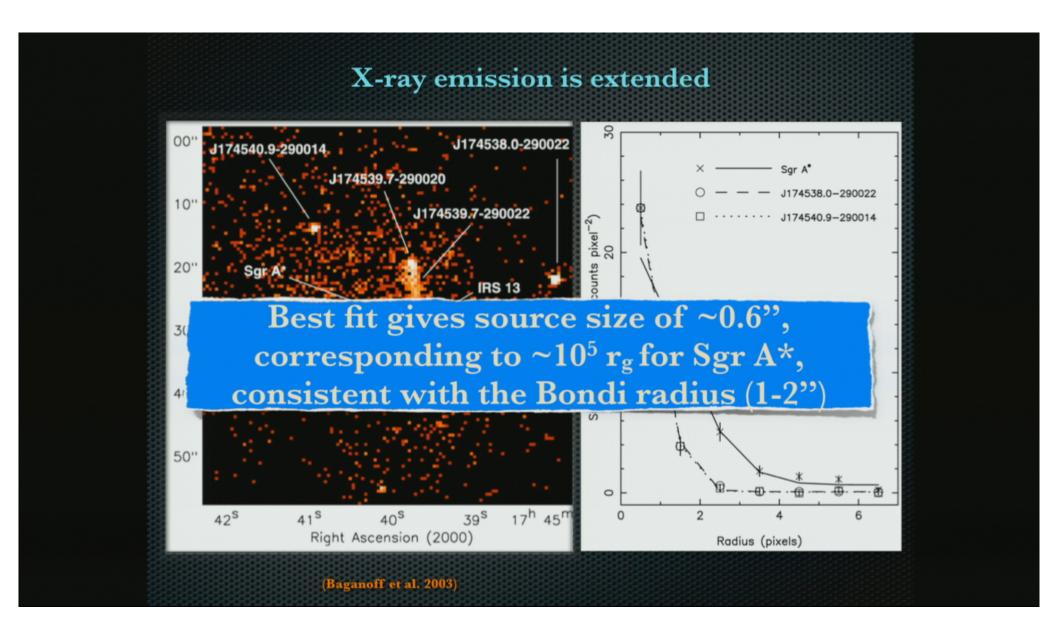
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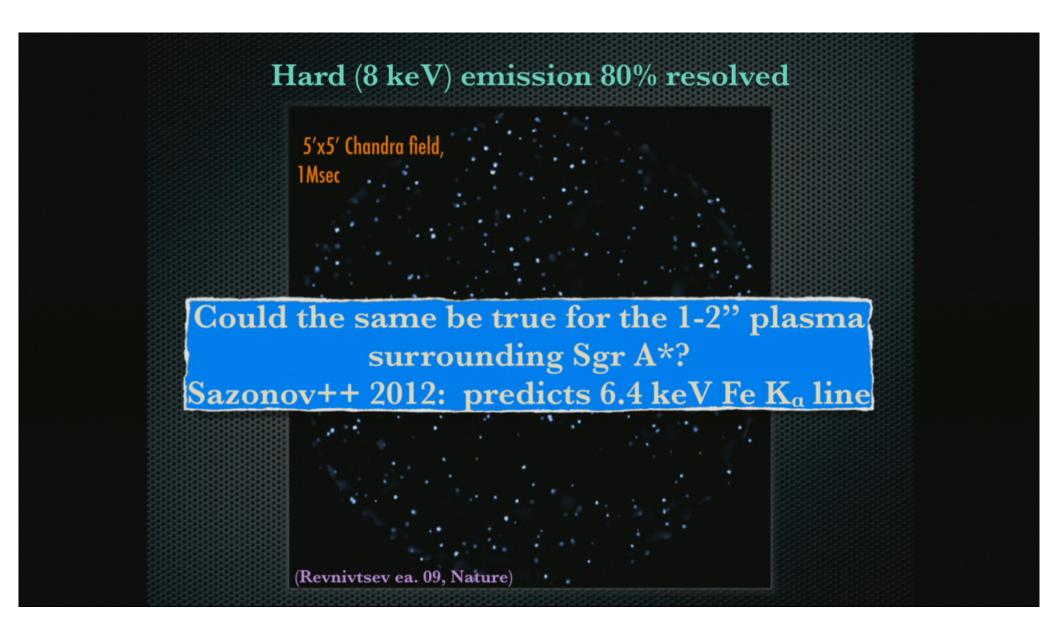
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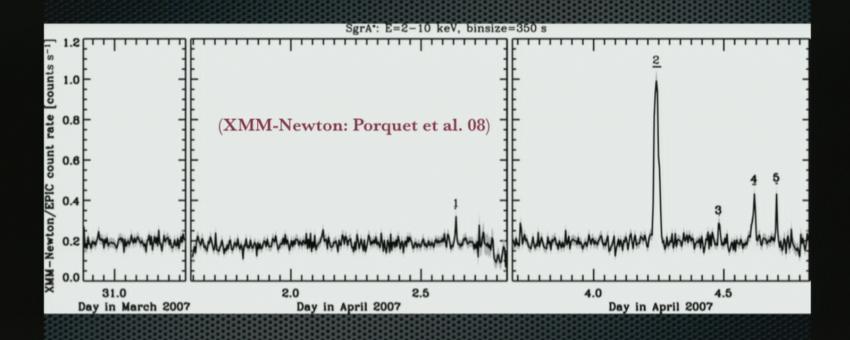


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Sgr A* flares — Roughly daily, few - 100x > quiescence



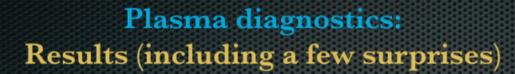
Many more flares detected with Chandra (+ XMM + INTEGRAL). Average flare ~ daily with 5-10x, but larger flares show "hiccups", like aftershocks!

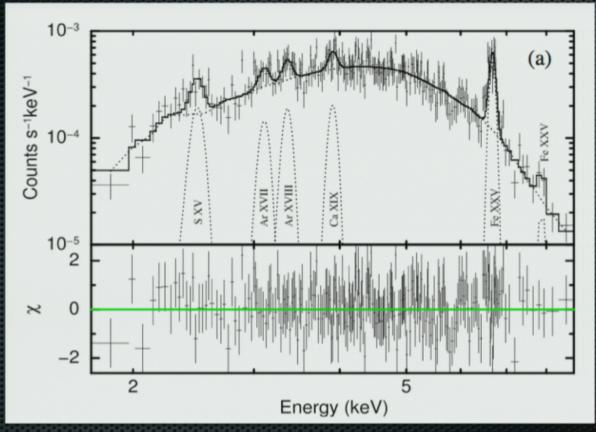
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Chandra-HETG observations of Sgr A*: an "X-ray Visionary Project" in 2012

★ 3Msec (35 days!) exposure of Galactic Center, 38 observations between February and October, 14 > 90ks (desirable for studying variability)

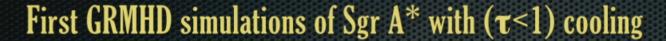
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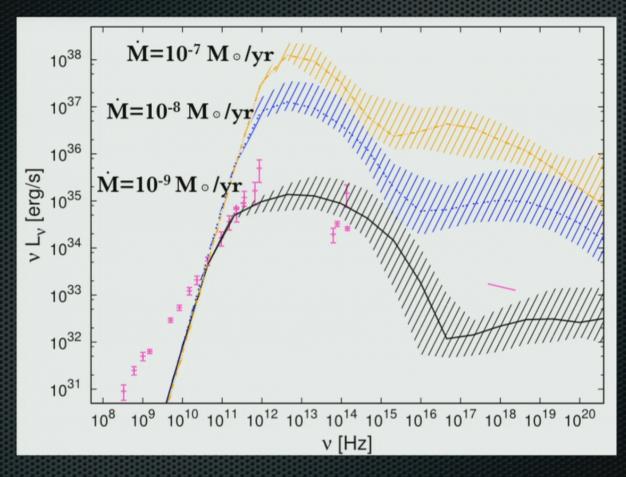




(Wang, Nowak, SM++, Science, 2013)

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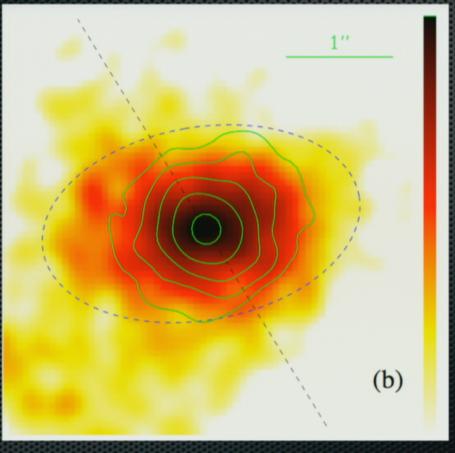




(Dibi, Drappeau, Fragile, SM & Dexter 2012; Drappeau, Dibi, Dexter, SM & Fragile 2013)

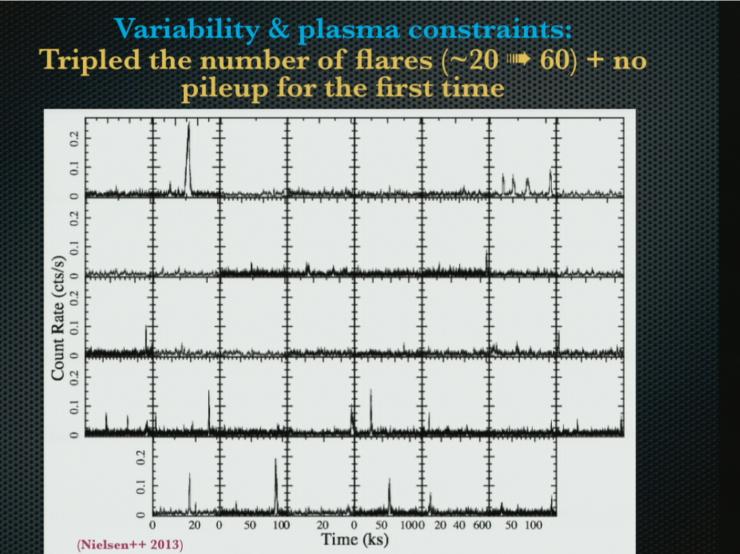
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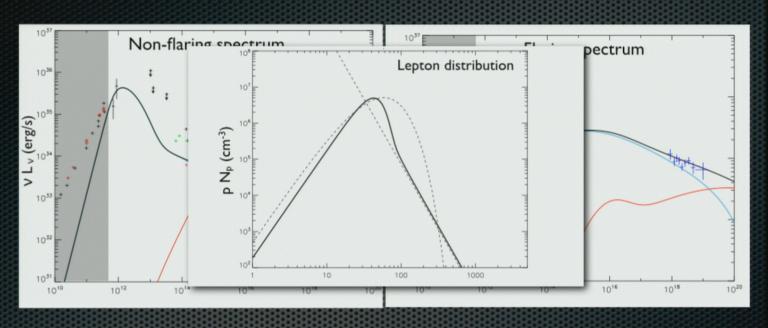
(Wang, Nowak, SM++, Science, 2013; and see also nxt talk: Bower, SM++ 2014)

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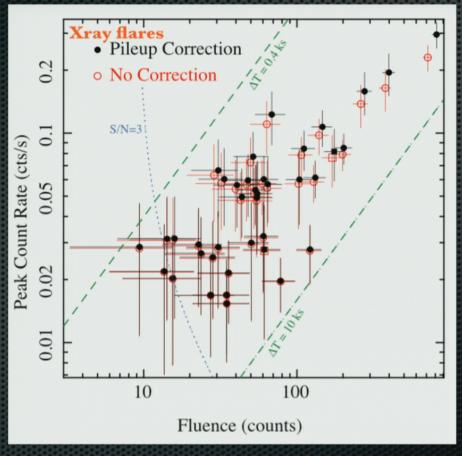


★ Magnetic injection: in the above example, the transition from quiescence to flaring is achieved by transferring magnetic energy to particle energy (mechanism not specified...see Eliot's talk!)

(Dibi, SM, Belmont & Malzac 2014)

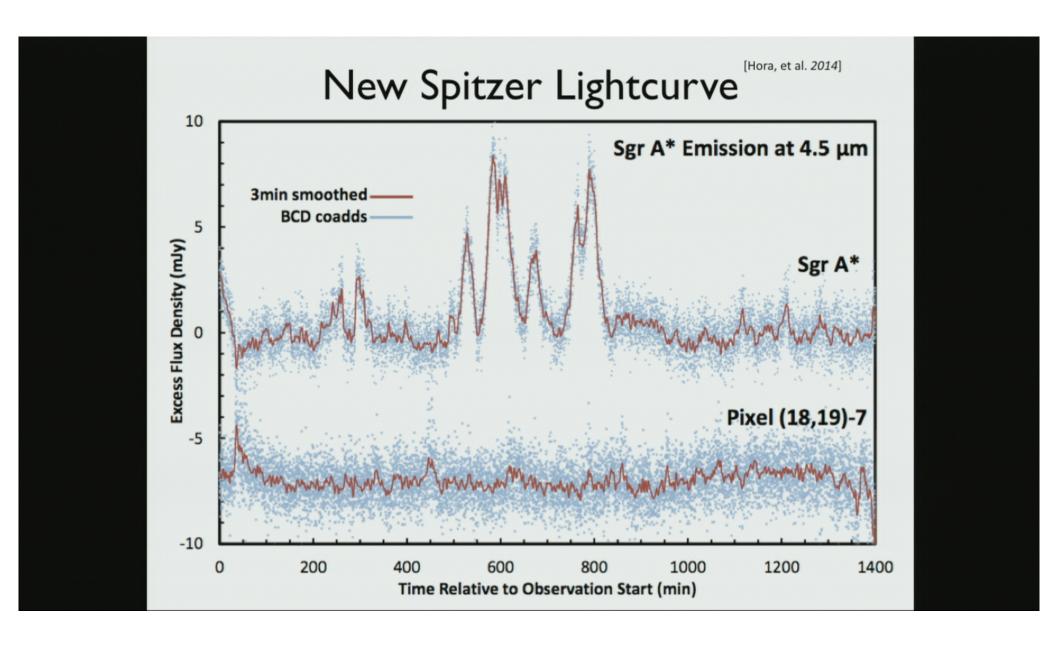
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Variability & plasma constraints: Able to perform statistics for the first time!

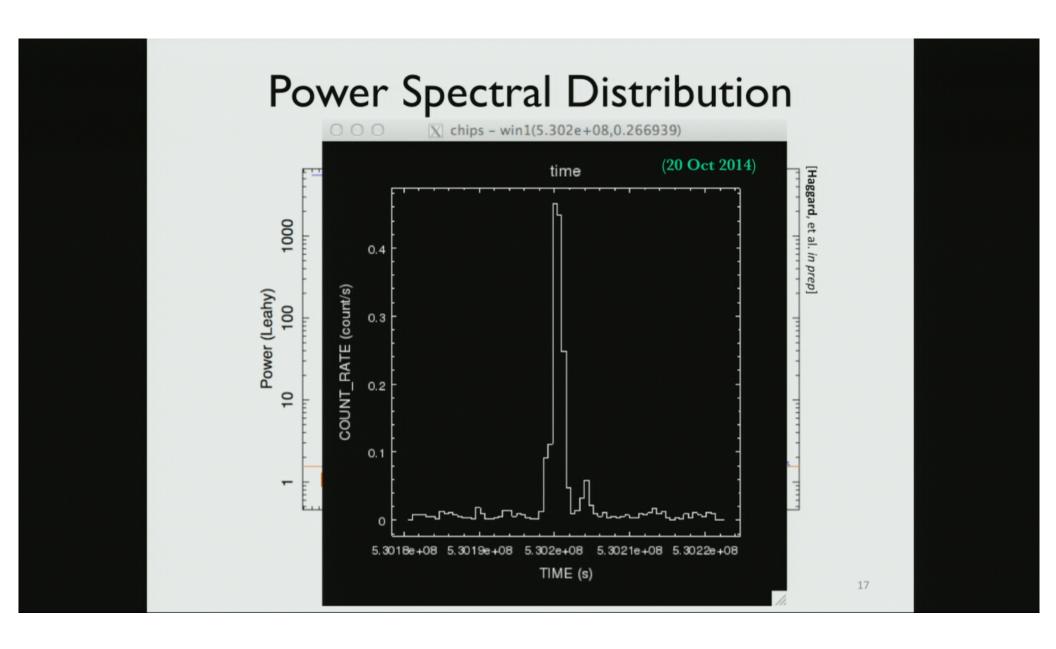


(Dodds-Eden 2009; Witzel++ 2012; Nielsen++ 2013, Nielsen, SM++, subm.; Dibi, SM, Nielsen++, in prep.)

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Need better MWL coordination!!

- **★ Lags (few hours) btw IR and (sub)mm?**Lots of observations planned for the coming year, including hopefully more uninterrupted Spitzer time to study longer term variability.
- ★ Spitzer window JunelJuly + Nov/Dec, but 3 element mm-VLBI is best in Feb April apparently (?)
- ★ Any chance for the potential EHT prototype run in 2015 to overlap the Spitzer/Chandra windows??

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