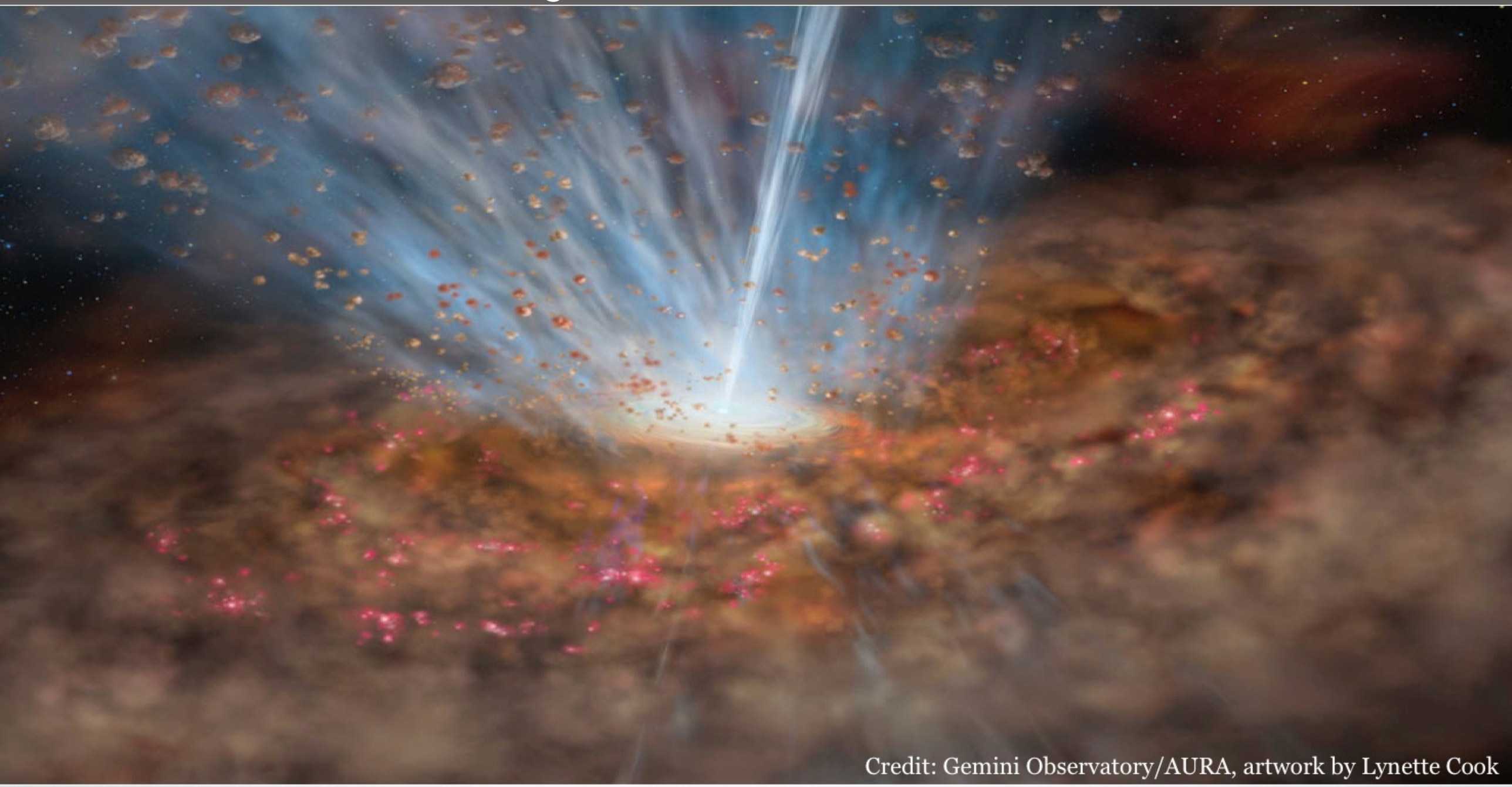
DO AGN WINDS ENRICH THE CGM/IGM?

Chiara Feruglio, Scuola Normale Superiore, Pisa

chiara.feruglio@sns.it

Feruglio et al. 2015, arxiv:1503.01481

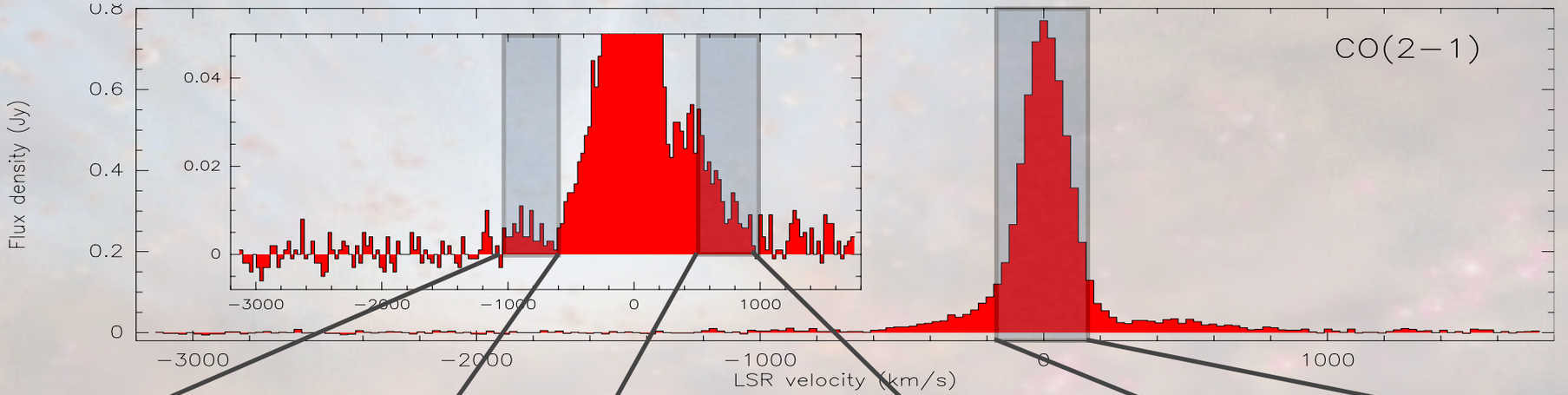


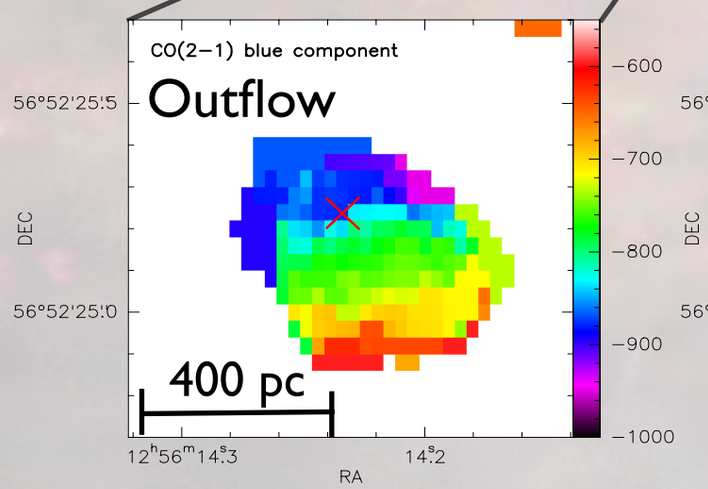
Credit: Gemini Observatory/AURA, artwork by Lynette Cook

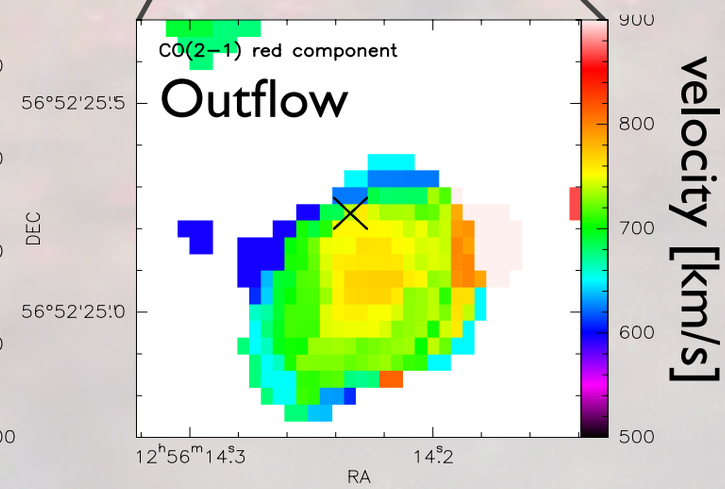
AGN-driven molecular outflow in Mrk 231

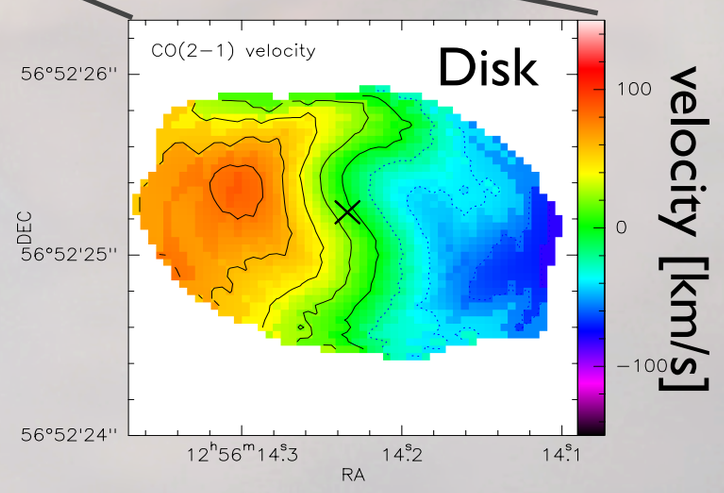
Powerful AGN-driven winds are seen in all gas phases, are massive and extended. Are they extended enough to contribute to the CGM/IGM metal enrichment?

We mapped the prototypical powerful massive molecular outflow of Mrk 231 with ~400 pc spatial resolution by using **IRAM/Plateau de Bure Interferometer.**









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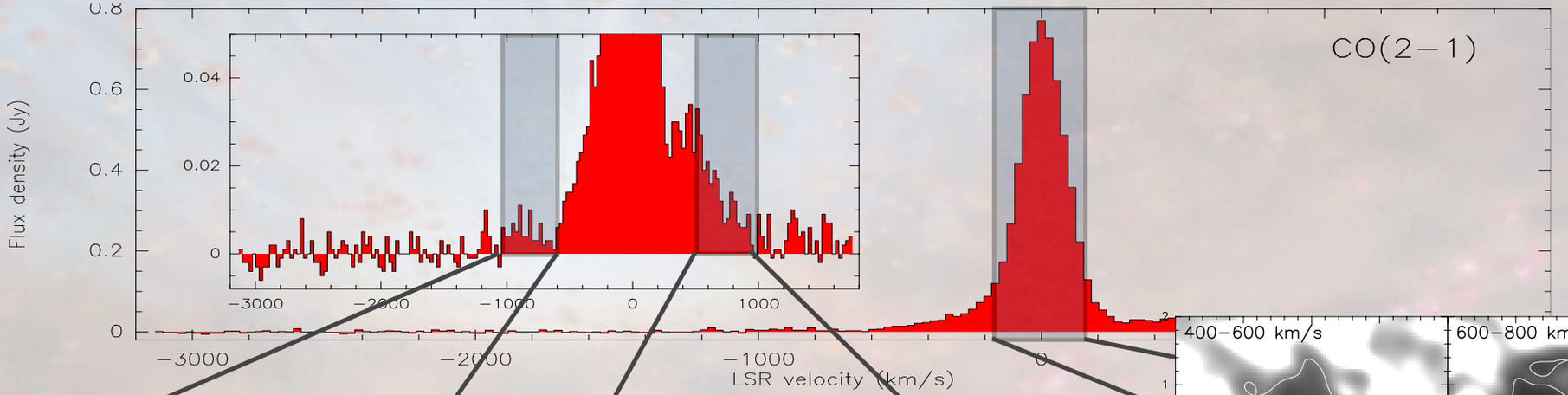

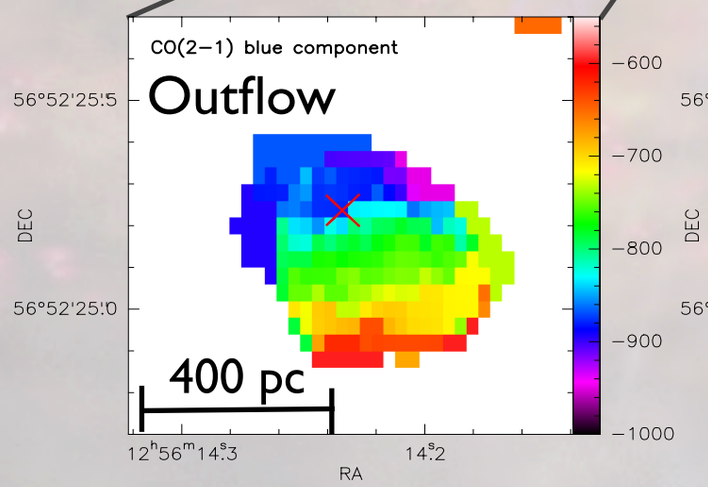

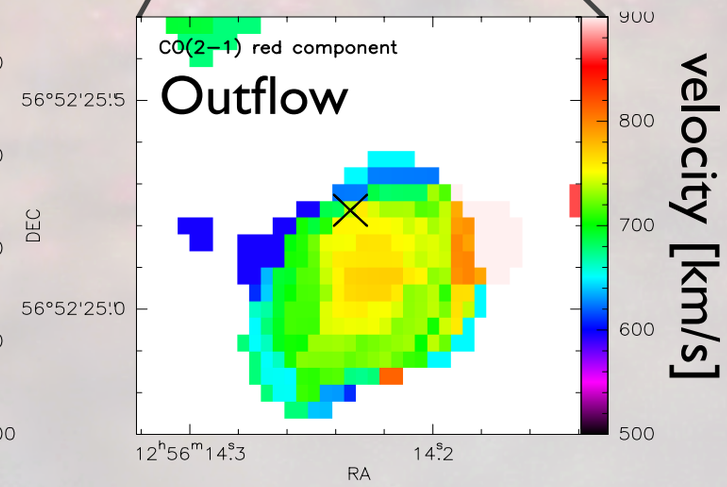

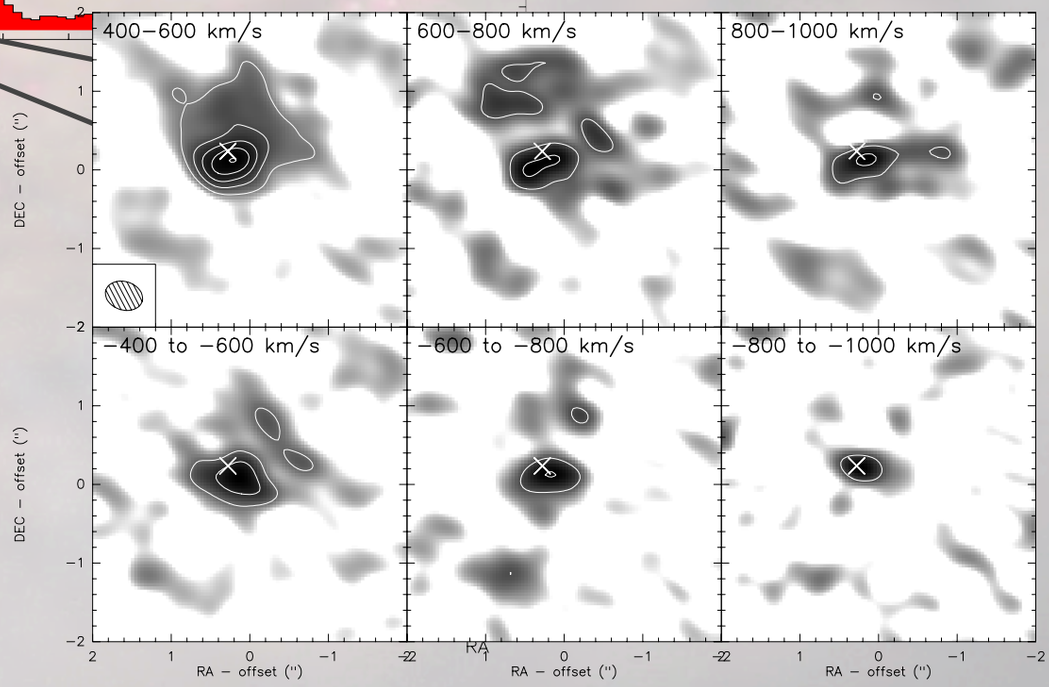

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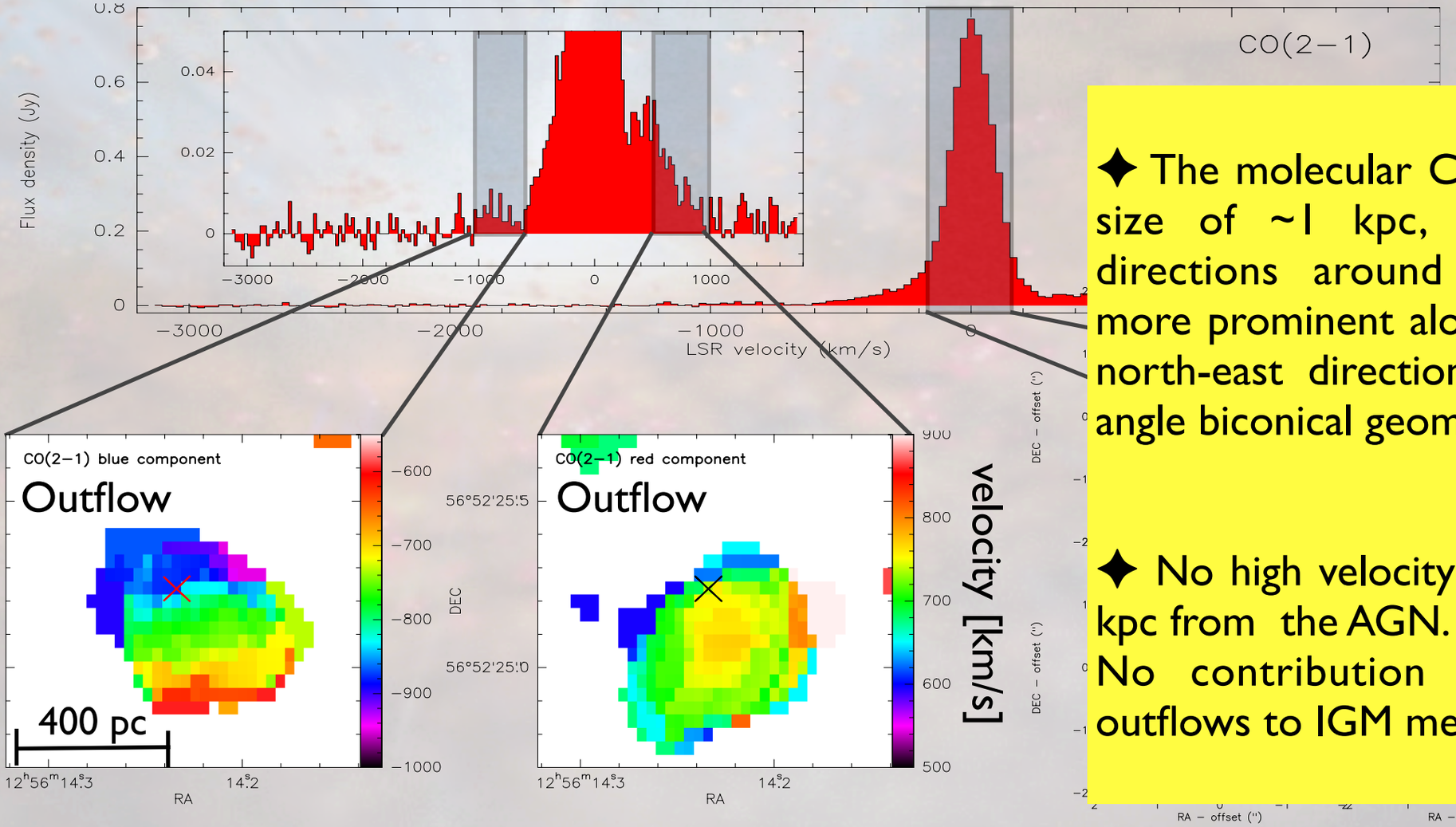


✦ The molecular CO(2-1) outflow has a size of ~1 kpc, and extends in all directions around the nucleus, being more prominent along the south-west to north-east direction, suggesting a wide-angle biconical geometry

✦ No high velocity CO seen beyond ~1 kpc from the AGN.
No contribution of AGN molecular outflows to IGM metal enrichment?

AGN-driven molecular outflow in Mrk 231

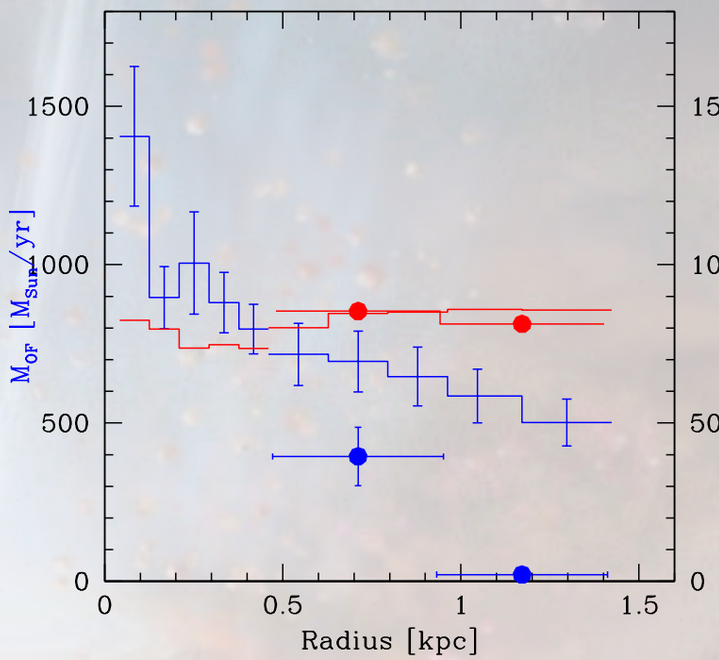
✦ Mapping mass and energy rate of the molecular outflow yields

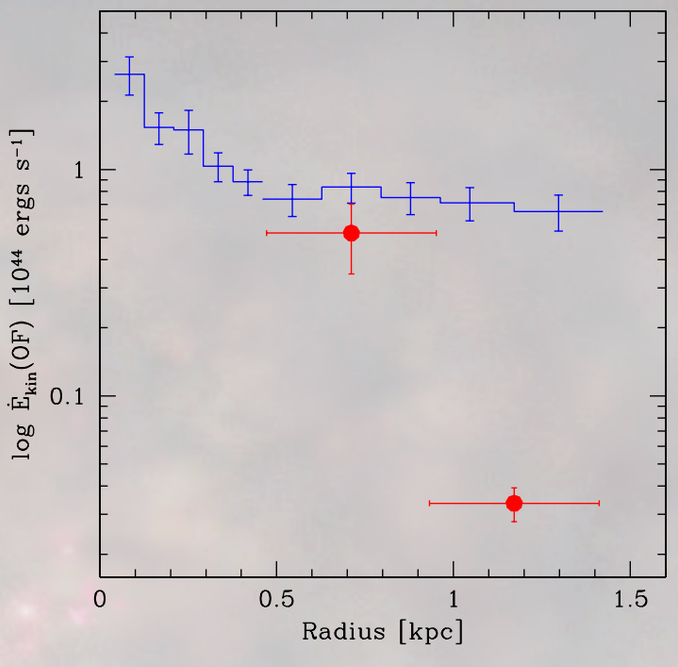
- M_{OF} = 500-1000 $M_{\odot}$ /yr
- $\dot{E}_{kin,OF}$ = 7-10 x 10^{43} erg/s

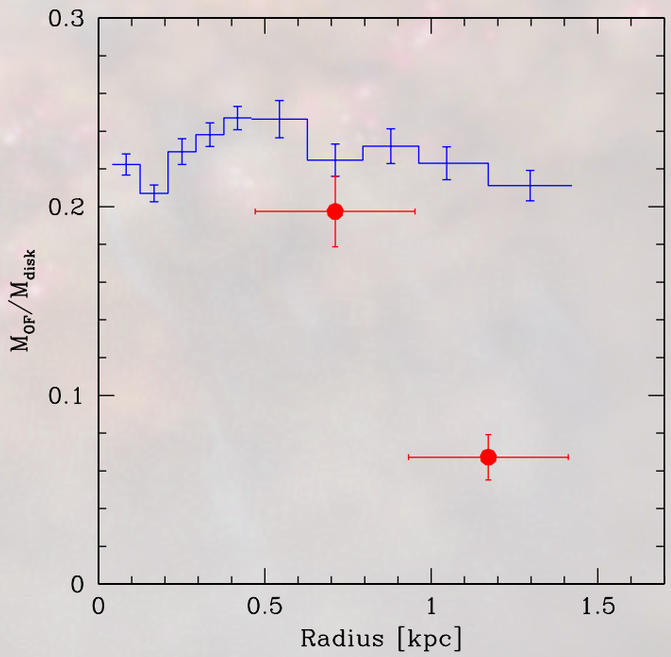
✦ The maximum projected velocity of the outflow is nearly constant out to ~1 kpc, implying that the density of the outflowing material must decrease from the nucleus outwards as $\sim r^{-2}$

✦ **CO below critical density, , not self shielded, photo-dissociated? Look for [CII] outflows on larger scales**

✦ The total kinetic energy of the outflow is $E_{kin,OF} \sim E_{disk}$
(i.e. the total energy of the molecular disk)







Integrated
In annuli

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