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The turbulent youth of a proto-cluster at $z=1.7$ in the J1030 field

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We are collecting deep multi-wavelength data on the field hosting the QSO J1030+0524 at $z=6.3$. This includes two of the deepest Chandra and JVLA (1.5 GHz) surveys to date. I will present the X-ray/radio properties of a large-scale structure at $z=1.7$ assembling around a powerful FR II, that dominates the center of the field. Extended X-ray emission has been detected around the FR II. Remarkably, four of the protocluster members lie in an arc-like shape around the main X-ray extended emission. We propose that such emission originates from an expanding bubble of gas shock heated by the FR II jet, that is promoting the star formation on nearby galaxies by compression of their ISM. If confirmed, this would be the first evidence of positive AGN feedback on multiple galaxies on hundreds-kpc scales. New LOFAR (150 MHz) observations reveal extended radio emission around the FR II lobes, likely linked to the diffuse X-ray structures. Exploiting the JVLA and LOFAR data we built the spectral index map, which reveals signatures of re-acceleration of the plasma in the outskirts of the lobes, possibly induced by interactions with the ICM. Finally, based on ALMA observations of the CO(2-1) transition, we recently discovered three new gas-rich galaxies belonging to the proto-cluster, in addition to a large molecular gas reservoir ($M_{H_2} \sim 2 \times 10^{11} M_{\odot}$) around the FR II host galaxy. Under simple assumptions, we show that the system will evolve into a $\sim 10^{14} M_{\odot}$ cluster at $z=0$ and that the FR II is the likely progenitor of the future BCG.

I will conclude presenting the X-ray/radio properties of the faint radio population in the overall field (~ 1300 radio sources down to $S_{1.5 \text{ GHz}} \sim 10 \mu\text{Jy}$), focusing on the AGN component.

Research area

Extragalactic Continuum (galaxies/AGN, galaxy clusters)

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