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Positive AGN feedback in Centaurus A

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Abstract. We observed the inner filament of NGC 5128 (Centaurus A) with the *Hubble Space Telescope Wide Field Camera 3* (WFC3), using the $F225W, F657N$ and $F814W$ filters. We find a young stellar population near the south-west tip of the filament. We constrain the ages of these stars to 1-3 Myrs. No further recent star formation is found along the filament.

We propose an updated explanation for the origin of the inner filament. It has been suggested (Sutherland *et al.* 1993) that radio jets can shock the surrounding gas, giving rise to the observed optical line emission. We argue that such shocks can naturally arise due to a weak cocoon-driven bow shock (rather than from the radio jet directly) propagating through the diffuse interstellar medium. We suggest such a shock has overrun a molecular cloud, triggering star formation in the dense molecular core. The outer, more diffuse parts of the cloud are then ablated and shock heated, giving rise to the observed optical line and X-ray emission.
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Figure 1 shows the colour composite image of the inner filament. Young stars, traced by NUV light, are only present at the south-west tip. Using stellar population synthesis models and single star isochrones, we find these stellar populations to have ages $\lesssim 10\,\mathrm{Myrs}$, and best-fit ages of $1-3\,\mathrm{Myrs}$.

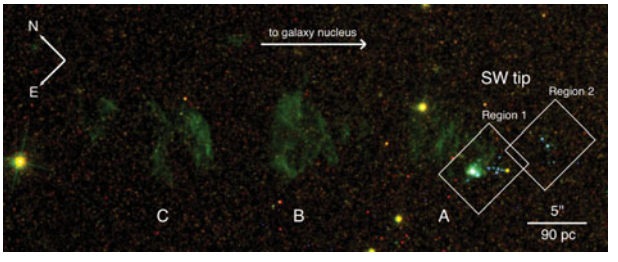

Figure 1. The inner filament in $F225W$ (blue), $F606W$ (green) and $F814W$ (red) filters.

The lack of recent star formation away from the tip of the filament, together with diffuse Hα and X-ray emission, suggests the inner filament may have been formed by shocking and ablation of a gas cloud by a passing weak shock. The dense inner parts of the cloud are radiative, and collapse to form stars. The diffuse outer parts are shock heated and ablated. Our simulations show that such a shock can be driven by the expansion of an AGN-inflated cocoon of radio plasma. The age of the young stellar population is consistent with both the radio AGN age and the travel time along the filament. We estimate the total mass of the disrupted cloud to be $\sim 6 \times 10^5 M_\odot$.

References

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