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## Resolved spectral ageing in 3C320 and 3C444

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Relativistic radio jets create large-scale lobes – the extragalactic footprints of accretion onto supermassive black holes, central to radio-loud active galaxies. In these dynamic and energetic structures, the phenomenon of spectral ageing occurs – the progressive steepening of the radio spectrum in the lobes due to radiative losses. Recent advances in computing capabilities have enabled this physical process to become a tool that can be used to calculate the age of radio galaxies – an important parameter used to determine their jet power (the time averaged kinetic feedback into the environment). In building the jet power function for all radio galaxies, accurate sources ages are required. Spectral ages, however, are almost always underestimated relative to the dynamical ages

of radio galaxies. In this talk I will present a detailed investigation of spectral and dynamical ages of two powerful cluster-centre 3C radio galaxies, using broad-band VLA data at multiple frequencies, and deep X-ray observations with Chandra and XMM-Newton of the surrounding shocked environment driven by the jets. Combined with an analytic model, we find that equipartition magnetic fields systematically underestimate the spectral age, revealing that the lobes of radio galaxies are truly a departure from minimum energy. Spectral ages can therefore be found accurately with true magnetic field estimates and accounting for electron mixing in the lobes. These findings will be key to building future tools to determine jet powers of all radio-loud AGN, which will be observed in the dawn of deep radio surveys such as the SKA, and will lead to information on the total power output of radio galaxies over all cosmic time.

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**Session Classification:** Extragalactic jets at all scales: from the central supermassive black hole to their interaction with the large scale environments