Modelling high-resolution spatially-resolved SNR spectra with the Sardinia Radio Telescope

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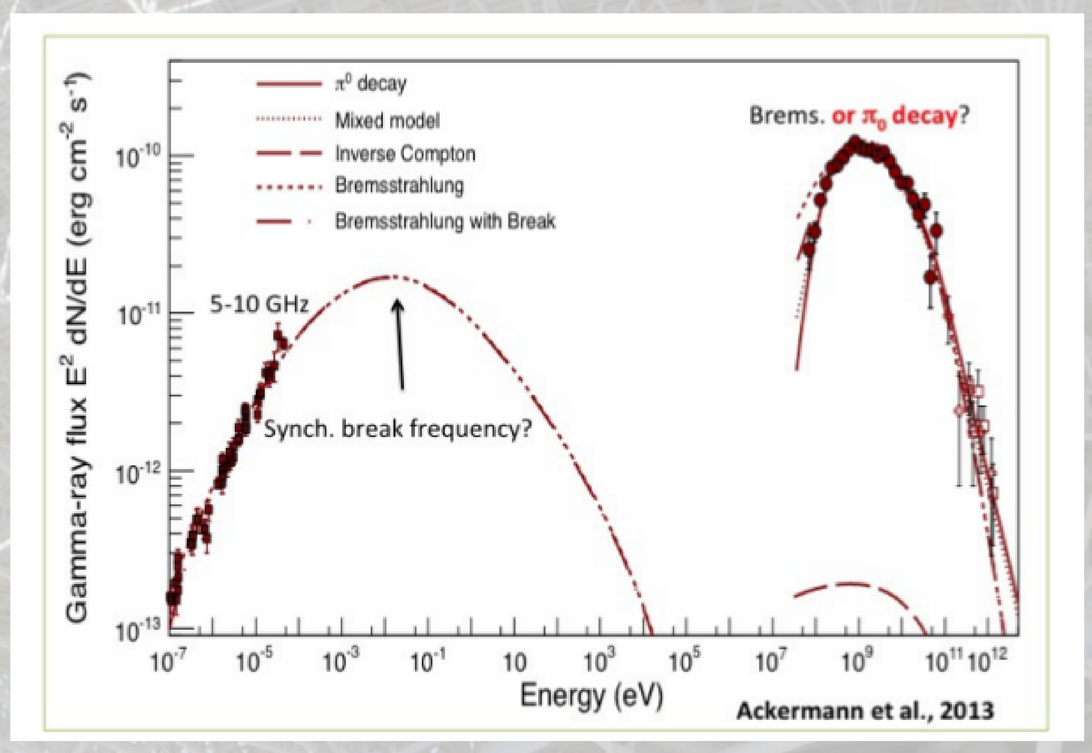
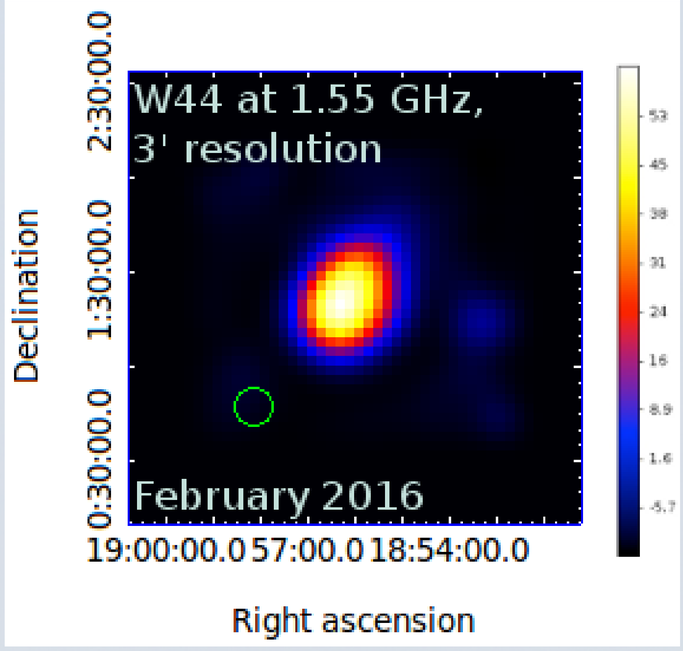
Abstract

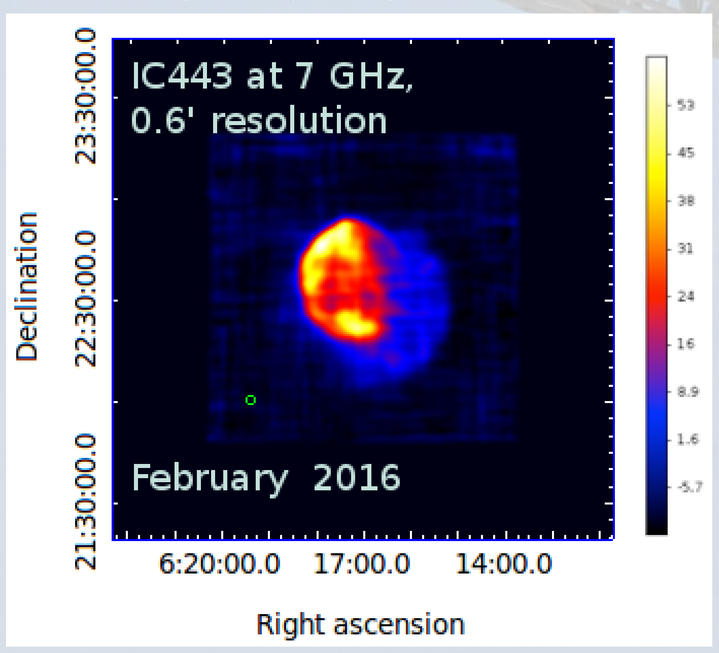
Supernova Remnants exhibit spectra typically featured by synchrotron emission mostly arising from the relativistic emitting electrons in the radio band and high-energy emission from both leptonic processes like Bremsstrahlung and Compton Inverse produced by the radio-electrons interacting with ambient photons, and hadronic process of π^0 mesons decay which is a direct signature of Cosmic Rays accelerated in Supernova Remnants.Thanks to radio imaging observations obtained in three frequency bands (1.4, 7, $22 GHz$) with the Sardinia Radio Telescope (www.srt.inaf.it), we can model separately different SNR regions. Indeed, in order to disentangle interesting and peculiar hadron contributions in the high-energy spectra and better constrain SNRs as Cosmic Rays emitters, it is crucial to fully constrain lepton contributions first through radio-observed parameters. In particular, the Bremsstrahlung and Inverse Compton bumps observed in gamma-rays are typically bounded to synchrotron spectral slope and cut-off in the radio domain, associated with different SNR regions and electron populations.

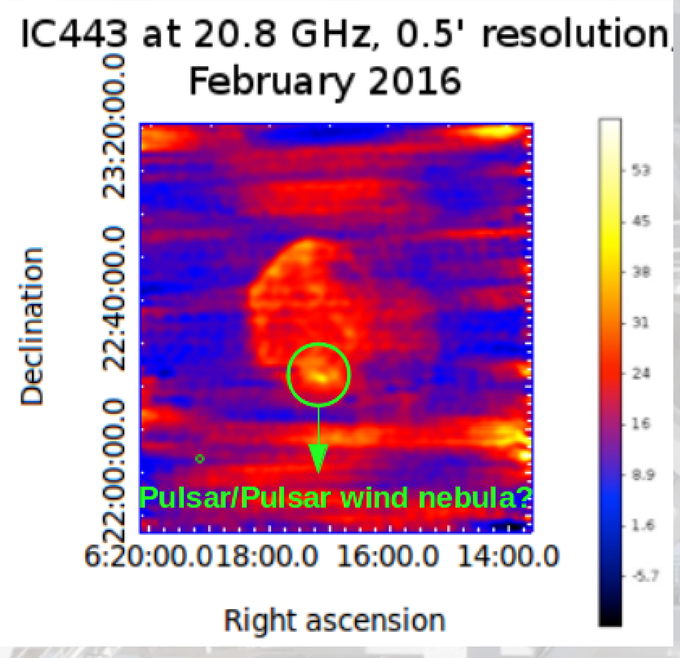
- Synchrotron-emitting electrons in the high-frequency radio band are responsible for the observed high-energy phenomenology as -e.g.- Inverse Compton and Bremsstrahlung emission components observed in gamma-rays, to be disentangled from hadrons emission contribution (providing constraints on the origin of cosmic rays).
- Multiwavelength data on SNRs are sparse and no spatially-resolved spectra are available in the $5 - 20$ GHz range, critical for model assessment, also for the most studied and bright objects
- Recent constraints on Cosmic Rays emission from SNRs and related models are based on integrated radio fluxes only implying the simplistic "single-zone" assumption of a single electron population for the whole SNR.
- With SRT we perform accurate on-the-fly scans of W44 and IC443 SNRs at three frequencies (L, C, K bands) in order to obtain detailed radio images and spatial-resolved spectral-slope measurements (synchtron spectral breaks are possibly expected in this range).

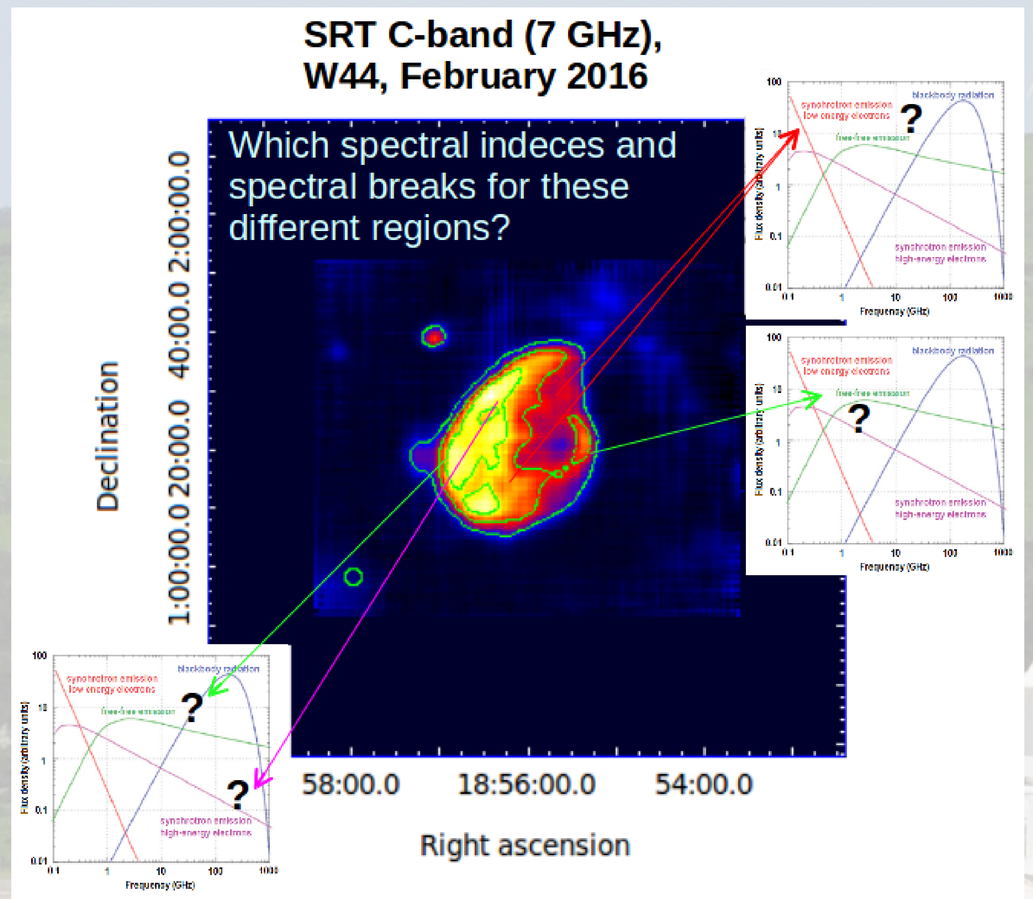


SRT multifrequency maps of W44 and IC443









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