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Discovery of an overionized jet-like structure in the SNR IC443

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“IC 443 is a supernova remnant (SNR) located in a complex environment and interacting with nearby clouds. Indications for the presence of overionized plasma have been found though the possible physical causes of overionization are still debated. Moreover, because of its peculiar position and proper motion, it is not clear if the pulsar wind nebula (PWN) within the remnant is the relic of the IC 443 progenitor star or just a rambling one seen in projection on the remnant. We addressed the study of the IC 443 X-ray emission in order to clarify the relationship between PWN and remnant, the presence of overionization and its origin. We identified an elongated (jet-like) structure with Mg-rich plasma in overionization. The jet is interacting with a molecular cloud and is aligned with the position of the PWN at the instant of the supernova explosion. Interestingly, the direction of the jet of ejecta is somehow consistent with the direction of the PWN jet. IC 443’s jet is the first one which shows overionized plasma, possibly associated with the adiabatic expansion of ejecta. The match between the jet’s direction and the original position of the PWN strongly supports the association between the neutron star and IC 443.

IC 443 is a supernova remnant (SNR) located in a complex environment and interacting with nearby clouds. Indications for the presence of overionized plasma have been found though the possible physical causes of overionization are still debated. Moreover, because of its peculiar position and proper motion, it is not clear if the pulsar wind nebula (PWN) within the remnant is the relic of the IC 443 progenitor star or just a rambling one seen in projection on the remnant. We addressed the study of the IC 443 X-ray emission in order to clarify the relationship between PWN and remnant, the presence of overionization and its origin. We identified an elongated (jet-like) structure with Mg-rich plasma in overionization. The head of the jet is interacting with a molecular cloud and the jet is aligned with the position of the PWN at the instant of the supernova explosion. Interestingly, the direction of the jet of ejecta is somehow consistent with the direction of the PWN jet. Our discovery of a jet of ejecta in IC 443 enlarge the sample of core-collapse SNRs with collimated ejecta structures. IC 443’s jet is the first one which shows overionized plasma, possibly associated with the adiabatic expansion of ejecta. The match between the jet’s direction and the original position of the PWN strongly supports the association between the neutron star and IC 443.”