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Limitations on the emitting particles spatial distribution and heating mechanism in relativistic jets

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Recent VLBI observations have revealed the AGNs with double- and triple-peaked transverse intensity profiles, particularly, M87 (Hada 2017, Walker et al. 2018) and 3C 273 (Bruni et al. 2021). There can be several reasons for such intensity profiles: (i) boosting and de-boosting of the emission from different parts of the jet; (ii) a spatial distribution of non-thermal electrons, which can be produced due to developing instabilities (e.g., McKinney 2006, Chatterjee 2019, Hardee & Eilek 2011, Nikonov et al. submitted), shear acceleration (Ostrowski 1990, 1998), Ohmic heating or equipartition (Lyutikov et al. 2005); (iii) a non-uniform structure of the jet; (iv) opacity effects (e.g., Zakamska et al. 2008). Many of these effects can contribute simultaneously (e.g. Gabuzda et al. 2021).

In presented work, we use magnetohydrodynamic semi-analytical models by Lyubarsky 2009 and Beskin et al. 2017 to explore the effect of stratified jet structure on the total intensity profiles. We show that double-peaked profiles appear either in the models with high maximal Lorentz factors or in optically thick conditions, and triple-peaked profiles in radio galaxies constrain the fraction of the emitting particles in a jet. The preferred models are the localization of non-thermal electrons at the jet edges and Ohmic heating.

Primary authors: Dr NOKHRINA, Elena (Moscow Institute of Physics and Technology); Mr PASHCHENKO, Ilya (Lebedev Physical Institute); FROLOVA, Valeriya (MIPT)

Presenter: FROLOVA, Valeriya (MIPT)

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